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MANURING TEA.

The results of the Experiments with Green Manures for Tea in progress at Peradeniya were brought up-to-date in Bulletin No. 9 of the Department of Agriculture published in May of last year. The object of these experiments is to determine whether nitrogen, the most expensive ingredient in artificial manures, could be supplied to tea by growing leguminous plants in the gardens to fix the free nitrogen of the atmosphere. The money expended upon nitrogenous manures in Ceylon amounts to close upon £300,000 per annum, a good proportion of which is on account of tea. This is therefore a matter of some concern to shareholders.

The plots, 15 in number each about one acre in extent (figures are corrected for acres), have been under experiment since 1906. Each has been given yearly 200 lb. basic slag and 60 lb. sulphate of potash in order that the tea should not suffer from a want of mineral food. It will suffice if we examine the results of the five plots of Manipuri indigenous, a variety well suited to the elevation (1,600 ft.).

Four were planted with green manures and one left as control. The effect of treatment was not noticeable till 1907, scarcely even then, so the year 1906 may be neglected. Crotalaria (2 plots), Dadaps (*Erythrina*) and Albizzias were the green

manures used and the mean yearly yields of made tea per acre for the 7 years 1907-13 were as follows:—

Plots.	Tea per acre lb.	Relative yield
146 Control	975	100
147-8 Crotalaria	1,083	111
149 Dadap	1,290	133
150 Albizzia	1,015	104

Dadaps increased the average yield by 33 per cent., Crotalaria by 11, but these proportions do not represent the benefit the tea was deriving from the green manures. As humus accumulated year by year we should expect to find results improve correspondingly and this is in fact what happened:—

	Control Tea per acre lb.	Relative yield	Dadaps Tea per acre lb.	Relative yield
1907	700	100	767	109
1908	591	84	780	111
1909	839	119	1296	185
1910	1167	167	1445	206
1911	1263	180	1720	246
1912	1028	147	1262	180
1913	1240	177	1760	251

In the seventh year after treatment the Dadap plot, the yield of which had increased by 142 per cent. since 1907, gave 520 lb. of made tea per acre, or 74 per cent., more than the control for the same year. The other green manure plots though not so good as Dadaps which are particularly suited to this elevation also showed substantial increases over the control the seventh year. The trials have, it will be seen, demonstrated that leguminous plants can be cultivated among tea with most beneficial results.

The value of Phosphoric acid and Potash as food for tea is illustrated in the experiments by the behaviour of the control plot which, under these manures alone, showed an increase of 540 lb. or 77 per cent. the seventh year as compared with the first.

The results of some tea manuring experiments on Pitakande group, Ceylon, covering 6 years from February 18th, 1898, to January 31st, 1904, designed apparently to illustrate the value of manuring tea, furnish some noteworthy results. There were 10 plots one being left unmanured as a control. No. 10 was dressed with "extra dissolved guano" and though taking the average of the 6 years it came out slightly ahead of the next in order, the results lose greatly in value by our not being told what the guano was. In the sixth year it fell to sixth place. The plot that did best was No. 7 with a mixture of Castor cake, Fish, Sulphate of ammonia and Nitrate of soda, all of them nitrogenous manures. This mixture it will be observed contained no purely phosphatic manure, fish containing a very much lower percentage of phosphoric acid than, for example, bone meal or basic slag. The plot, which was first in the sixth year received less phosphoric acid than any other except No. 4 which was seventh and received practically none at all. No. 3 was the only plot that received no nitrogen but phosphoric acid and potash only [Basic Slag and Sulphate of Potash] and of the manured plots was last in order throughout. The comparative failure of phosphatic manures in these tea manuring experime ts is significant.

But the most remarkable feature about the Pitakande experiments is that after the third year was passed a sudden and serious drop in yields occurred which with a slight recovery the fifth year was maintained in the sixth. The average for the manured plots in 1898 was at the rate of 1012 lb. made tea per acre, that for 1903, 540 lb.; a falling off of 472 lb. All the plots partook of this decline including the control which fell from 707 lb. to 357 lb. It was not presumably due to pruning which it is stated took place in 1899, 1901 and 1903, at equal intervals throughout the course. Finer plucking might have been resorted to which would account for it to some extent but it is not possible from the published accounts to determine what happened.

R. N. L.

RUBBER.

THE THINNING OUT OF HEVEA RUBBER TREES.

E. B. SKINNER.

On one estate where the trees were planted at 14 ft. by 24 ft., the yield was very good until about the sixth year of tapping. The trees were then a good deal overcrowded, and it became quite noticeable that the yield was falling off. At the same time, the renewed bark surface became uneven, and it was impossible to avoid wounding, in fact many of the trees in this area felt the effects of tapping so much that they became permanently injured, and that in spite of the fact that the standard of tapping on the estate was very good, and that wounding on normal bark was of rare occurrence. It was then decided to cut out the worst trees, in order to save the better ones, to stop tapping entirely on renewed bark, and to tap lightly on original bark above the bark that had been tapped previously. The trees were therefore reduced from about 200 to about 90 to the acre.

The result of this was that the yield per tree for the following year rose 80 per cent., and the renewal of bark showed signs of great improvement. It is now four years since this was done, and the bark renewal is so good that the trees are not fit to be tapped below, on the surface which had suffered so severely previously. The yield has also become normal, and gives promise of increasing yearly.

At the same time it must be noticed that the renewal of bark, though satisfactory, has not been so rapid as it would have been had these favourable conditions been established earlier. The head of leaf when cutting out was begun was very small, and it will still be some time before the trees produce branches and leaves enough to give the very best yield. Similar results were obtained on another area where the trees were originally planted at 10 ft. by 10 ft. When tapping was started, there were about 300 trees to the acre. These were first reduced to 100, and afterwards were gradually thinned out until the whole number is now about 60 to the acre. It is interesting to note here that at its best this area yielded as much as over 900 lb. per acre. but after reaching this point the area rapidly showed the results of close planting, and before thinning out began the yield had dropped to below 400 lb. per acre, and the trees showed bad renewal of bark, low percentage of No. 1 rubber, and all other effects of close planting. Other areas may be mentioned, planted originally at 20 ft. by 20 ft., where the trees were not thinned out until they were about nine years old. At this time the surface of the trees had not begun to suffer, but it was noticeable that the yield had ceased to increase, and had even begun to fall off, that the bark renewal was becoming slower and slower, and that the branches had dropped off, and were being replaced by suckers. The growth also remained practically stationary. These trees were thinned out, leaving from 70 to 80 to the acre, according to local conditions.

Our experience in these cases as in many others has, then, convinced us that thinning out of closely planted areas leads surely and certainly to an increase in the yield and a quicker renewal of the bark.

We may now proceed to consider the second great advantage claimed for a widely planted, or severely thinned out estate, over a closely planted one, namely :—

The greater economy with which it can be worked.

First, let me emphasize again what I have already pointed out, that the yield from, say, an area of widely planted trees will be as great as, or greater than that from an area of closely planted trees. Bearing this fact in mind, it may be asserted in the first place that fewer coolies will be required for tapping since fewer trees will have to be tapped to produce, say, one pound of rubber. I have heard it said by the critics of thinning out that a cooly who taps an acre has to cover an acre, and that if his task is, say, 300 trees, he will get through it quicker if they are all on one acre than if they are on several. In fact, however, it is not the actual area on which the trees stand which counts, but the number of rows up and down which a cooly has to walk, and it is obvious that there must be more rows of trees in an acre bearing 300 trees than in an acre bearing, say, 70 trees. The cooly's task is not proportionately increased if he has to cover four acres widely planted, as he has fewer rows to walk up and down.

In view of the excellent results obtained by contract or bonus tapping, we may also look at the matter in another way. On a widely planted estate, though a cooly has to take a few extra steps between each two trees, he has to make fewer cuts to obtain his given amount of rubber ; he has fewer spouts to clean, fewer cups to wash, fewer cups to put into position for the collection of latex, and fewer shavings to collect. It follows, then, that he may be expected to bring in more rubber as a daily task, from a widely planted estate than from a closely planted one, and hence there is also a great saving in the cost of collection. We may take it that a fewer coolies are required to produce the same amount of rubber where the trees are widely spaced, and fewer coolies means a smaller wages bill and a lower f.o.b. cost.

Other economies also result. On the basis of an acre bearing, say, 70 trees yielding as much as one bearing, say, 150 to 200 trees, an enormous saving is effected in the outlay on cups and spouts. This is so patent that we need not go into calculations of the cost of one cup or one spout, and multiply by 70 or 200 to show exactly what is saved. It is quite certain that a great deal of expense is saved on spouts and cups, meaning an appreciable amount per pound of rubber.

Under present market conditions the proportion of No. 1 rubber to the other grades is a very important question. A few trees produce a large quantity of rubber, and fewer spouts are required, so the quantity of scrap rubber is reduced. The same is true of cup washings and shavings, since fewer cuts and cups are required to collect the same quantity of rubber. Hence a higher proportion of No. 1 rubber to the total crop, and a larger average price realised.

It must certainly have fallen within the experience of some planters that weeding has become more expensive where an area has been freshly thinned out. More light penetrates to the ground, and in consequence more seeds

germinate, and a larger crop of weeds is the result. We have always found that the cost of weeding has gone up after thinning out has taken place, but we have never found this effect to be other than temporary. On a well-weeded estate such a flush of weeds is very easily controlled and if the newly grown weeds are not allowed to seed, the cost should not increase for more than one month or so, after which the increased spread of the branches produces shade and hinders the growth of the seeds. Where the weeds are not removed the mischief is, of course, more serious, though even here the rapidly increasing spread of the branches of the remaining trees would tend to check the weeds in time.

We may say, then, that by thinning out fewer coolies are required to produce each pound of rubber, fewer cups and spouts are used, less low grade rubber is produced, and expenses (except some times temporarily for weeding) are substantially reduced in many directions. From our experience it seems undoubted that the latex of well renewed bark from widely spaced trees yields a much higher percentage of No. 1 rubber than the latex from closely planted trees. From the evidence we have been able to collect so far, the difference appears to amount to not less than 10 per cent.—INDIA RUBBER JOURNAL.

RUBBER COLLECTING IN THE REMOTE INTERIOR OF SOUTH AMERICA.

LEO E. MILLER.

The trees are girded with strips of palm pith at the base which intercept the latex and deflect it into a folded leaf placed underneath. This system is rather wasteful and injurious to the trees. There is no fixed rule or custom for tapping the trees, the men hacking into the bark at random, but occasionally the herring-bone pattern of cut is used. Each man has two routes, and endeavours to have from three to five hundred trees on each, seldom more, often less, according to the abundance of the rubber trees in the locality. He takes one trail one day, and the other the next, thus permitting the trees to rest on alternate days. If it rains the day's catch is spoilt as latex mixed with water is worthless. The season of 1913 had been a poor one ; at the beginning the flow was abundant and of good quality; one hundred pounds of latex yielding sixty pounds of rubber. That was in December ; by May five hundred trees were producing only twenty-five pounds of milk, and this was of such poor quality that it contained but 40 per cent. of rubber. Of course, the trees had become weakened as the season advanced, which also accounts for the decrease in yield, but the main trouble had been almost constant rains long before the regular wet season. The milk was weighed as brought in by each man at midday and credited to his account ; in the afternoon the whole force repaired to smoke-house to work up the day's catch. A kind of wood called Mazarandul is used exclusively for the smudge ; it is of a deep reddish colour and grows plentifully along the river.

The cost of transportation between the Upper Orinoco and Ciudad Bolivar is enormous. In the first place, the distance is very great and the river is full of rapids, necessitating long overland portages ; all provisions

have to be brought up, and the crude product has to be taken back down; there is always a great loss both ways from theft and wreckage, and as there is no regular system of navigation beyond the mouth of the Apure, the difficulties encountered in securing boats and crews are tremendous.

In the working camp (at Calama on the Madeira) conditions are better than in many other regions A rigid set of rules has been formed regulating the tapping of rubber trees, with which all tappers are compelled to comply in bleeding the precious *Hevea Brasiliensis*. At first a long-handled, narrow-bladed axe is used, which enables the men to make an incision at twice their height from the ground. No tree is touched unless it has a circumference of at least four spans (all measurements are made with the hands, for convenience) and all cuts must be two spans apart, so that if a tree has a circumference of twelve spans, a circle of six spans is made each day. At first these cuts are of too great height above the ground to permit of cups being placed to catch the latex, but they are necessary to stimulate the flow on the sap, which nature intends to cleanse and close the wound so that it may readily heal. To facilitate the healing process the cut is not made at right angles with the tree, but slantingly. Each day a new ring of cuts is made one span below that of the previous day, so that within a week after starting a tree the cuts are within reach and the flow of milk is sufficient to be collected. A small tin cup is pushed into the bark under each incision, into which the sap flows. A short-handled axe is now used and the rows of cuts, one beneath the other, are continued until the ground is reached, when new ones are started just half-way between the old ones, and this is continued indefinitely so that the original openings are not reached again until many years later when they have of course completely healed. The collector starts out in the early morning making the cuts and placing the cups, then he retraces his steps and collects the catch. Should the day be very windy he will probably find that instead of a liquid each cup will contain a neat little white cake of cheese-like consistency; the natives attribute this coagulation of the latex to the action of the wind, but the real cause may be traced to the multitude of small particles of bark and twigs that have fallen into the cup; if the cake be cut open, a great many impurities will be found imbedded in the interior like raisins in a muffin.

Great care must be exercised in smoking the latex of *Hevea*. If allowed to stand too long, the finished product will contain numerous small holes, like a cheese, and will be graded as of inferior quality. If prepared while perfectly fresh, it is smooth and firm and of the best quality. In preparing rubber in the old way—that is by pouring the latex over a paddle and revolving it in a column of smoke until a ball weighing several hundred pounds had been formed—there was always a considerable amount of loss to the producers, and for the following reason:—It required the run of many days to produce a ball of this size with the result that on some days the latex was prepared properly and a perfect layer was added to the rapidly growing ball, while on the other days the layer added was of a porous consistency. When the ball was finished and cut open for inspection the two qualities showed plainly and the whole ball, including the first-class layers, was classed as *entre-fina* or second quality.

The Asensi company has evolved a method of working up the latex that eliminates all this loss. Instead of the paddle, a wood cylinder nine

or ten inches in diameter and a foot wide is used ; there are low flanges on the ends, and the whole resembles a shallow pool. After having been smoked the cylindrical piece of rubber is slipped off the form and cut open, resulting in a flat slab. This process possesses many advantages. Each slab represents one day's work for one man ; the quality of the rubber is immediately visible, and the surface presented to the smoke is so large that it takes less time to prepare the latex. The flat slabs pack easily and save all the space that is lost in packing the large, unwieldy balls ; there is no possibility of mixing the two qualities, and the slabs dry perfectly and cut down the dead weight of water. In smoking the latex of *Hevea brasiliensis* the nuts of *Attalea excelsa* are used exclusively for the smudge.—

INDIA RUBBER WORLD.

SOME NOTES ON THE RESEARCH WORK OF THE RUBBER GROWERS' ASSOCIATION.

A. BETHUNE.

In 1907, when the potentialities of the rubber growing enterprise were beginning to attract attention, MR. H. K. RUTHERFORD called together a few Ceylon and Malay States planters and merchants, and the R. G. A. was founded. In 1912 it became an incorporated association, and has since gone on from strength to strength. The membership now consists of nearly 400 companies, with a capital exceeding fifty-millions sterling, and over 200 private members. In 1909, mainly at the suggestion of MR. G. A. TALBOT, it was decided to institute a research fund, the object being to improve the manufacture of rubber on estates, and to keep a careful watch on the pests and diseases to which all tropical agriculture is subject. A full measure of success, has attended these endeavours, and now, while the treatment of all the diseases is thoroughly understood, the proportion of perfectly prepared rubber which comes forward increases year by year. It is not, of course, claimed that this is entirely due to the work of our research funds ; the local Governments maintain an efficient staff of scientists, and there are other agencies at work, but one assertion I can make without fear of contradiction, that without our contribution to the common stock, the British rubber industry would not occupy the position it holds to-day.

In the nature of things it has been found necessary, much as it is to be regretted, to confine the circulation of the many valuable reports issued to those who subscribe to the funds, and thus there exists in some quarters a good deal of ignorance as to what has been achieved, and even some scepticism as to whether any practical results have been reached. That this scepticism is not shared by those who know is shown by the facts that the number of subscribers is steadily increasing, and the Research Committee have allowed me in this article to give some general indication of the work being done. First of all the staff. At the head of it is the Research Committee, of which MR. TALBOT is chairman, and the present writer convener. The consulting chemists are MESSRS. CLAYTON BEADLE and STEVENS. In the Malay States there is a strong local committee, of which MR. J. MORTON, OF MESSRS HARRISONS AND CROSFIELD, is secretary. The Senior scientific officer is MR. SIDNEY MORGAN, A.R.C.S., F.C.S.,

and the mycologist, MR. O. T. FAULKNER, B.A. In Ceylon there is a similar committee, MR. L. M. W. WILKINS being secretary, MR. KENNETH G. MARSDEN, B.A., scientific officer and MR. A. T. REEVE mycologist. At intervals of three months or thereabouts, reports are issued made up from information supplied by local to the London chemists. These are sent to all subscribers or guarantors. In addition, from time to time local reports are furnished to the local committee of control, and copies of these are sent to London. Of what, it may be asked, do these reports consist? Simply of the matters which occupy the mind of the rubber planter. The three most recent reports lie before me, and I select at random a few of the subjects treated. The Byrne-Jackson curing process: Variation in plantation rubber: An interview with a rubber manufacturer: The principle of smoke coagulation: Comparative cost of handling sheet and crepe: Percentage of grades: The use of sodium sulphite: Sheets stretching rusty: The influence of the tapper's skill on yields.

I have referred to our having chemists in London and in the East, and it should be added that we possess well-equipped laboratories in the Malay States on Pataling near Kuala Lumpur, and at Ceylon at Culloden in the Kalutara district. In London the consulting chemists have, of course, their own laboratory, with a volcanizing plant as well, and samples are constantly passing to and fro for examination and report.

Without going too deep into technicalities there is one point bearing on the good work done by our chemists which may be here referred to.

At the recent Rubber Exhibition, the R.G.A., owing in a great measure to the energy of our present Chairman, MR. JOHN MCEWAN, was much in evidence, and amongst other features, some interesting conferences with manufacturers were arranged. One point which prominently emerged was the advice given us not to "work" our rubber too much, in other words, whenever possible to make sheet instead of crepe. In some quarters this has been hailed as a wonderful new discovery, but as a matter of fact, this is the advice which our London chemists have been giving us for years. This is not to say, of course, that there is no use for crepe. For the American market, and for medical purposes, it will probably always be wanted, but the trend of opinion is in favour of sheet, and the services of DR. STEVENS and MR. MORGAN in this regard should not be forgotten.

Those who have only a bowing acquaintance with the great rubber industry sometimes asks this question: "What is the use of all your researches if when all is said your rubber fetches a lower price than hard Para?" I think I can answer this objection in six words—the age of miracles is past. When we consider the limited and stationary production of hard Para, some 15,000 tons, the ultra-conservatism of manufacturers, especially in this country, and the unsuitability of their machinery and methods for a new and different product, the leaps and bounds with which our production has increased, the number of weak companies begotten by the rubber boom, which are always eager sellers, when, I say, we consider all these things with an unbiassed mind, we must indeed marvel that the difference between the two classes is so small. What we have got to do is not to worry about the small and decreasing gap between the two, but to make our product equal to or superior to anything that can be brought in

competition with it. Prices will then adapt themselves to circumstances. Even now it is claimed that the best smoked sheet is equal in all respects to Brazilian rubber, but all the rubber shipped from the Estate is not best smoked sheet. Here other considerations come in. All estates are not furnished with sufficient drying accommodation and modern machinery. All planters are not Admirable Crichtons, and there is much yet to be done; but if we aim at the sky we may at any rate hit the top of the trees. It would appear from the testimony of our customers that we know how to make the rubber that pleases them, it remains to get the largest number of producers to conform to the best methods of reaching that result. I know no better way of forwarding the object we all have in view than by supporting Malaya and Ceylon Research Funds of the Rubber Growers' Association.

Note.—The following particulars are taken from a pamphlet issued in June:—

MALAYA RESEARCH FUND.

Ninety-six companies guarantee £2,562 per annum for the same purpose in the Federated Malay States.

CEYLON RESEARCH FUND.

Fifty six companies guarantee £2,325 per annum towards the expenses of chemical, botanical and other scientific research work in connection with the rubber industry in Ceylon.

INDIA RUBBER JOURNAL.

CATCH CROPS WITH RUBBER.

Travancore:—A planter writing on Dec. 5th furnishes the following interesting details re catch crops in rubber clearings:—

Being interested in the catch-crop question in new clearings and reading the article contributed by a correspondent in your November issue under that head, I send you the following results obtained here for what they are worth. I have had 24 years' experience of various products. This estate is on low-country level at the foot of the Ghats, with an annual rainfall of 70 inches fairly well distributed. The clearing was commenced last year, and rubber planted in June. Cassava was interplanted over 40 acres, and Cambodia Cotton over about 100. The Cassava was harvested from August to October this year, remaining in the ground 12 to 15 months. There are varieties here that have to be taken up in 6 months, but others are better left for over a year as the tubers increase greatly in size the latter 6 months. The cuttings were planted about 5 feet apart on ground previously loosened up about 4 inches. This is not sufficient but I was pressed for time. The crop gave Rs. 1,250/- which is about Rs. 30/- per acre. Only 3 feet each side of the rubber was left uncultivated, and this without doubt was too close and retarded the growth of the rubber in that area. This year I am allowing 6 feet on each side and the rubber seems not to be affected. I have also dug the ground deeper, forming beds across the slopes about 5 x 2½ feet, with a

catch drain alongside each. This holds all the rainfall even during heavy showers. Cassava being very exhausting, I have found that even on very good soil it does not pay to plant after the third year. On virgin soil with good cultivation I have obtained Rs. 100/- per acre. I made some into flour; 100 lb. raw root yield 11 lb. flour, costing Rs. 1·30 to make.

Cotton does not pay. I only got Rs. 120/- but have left it over for another year without pulling it up and although this year's yield will be four times last, yet it is not profitable. The rainfall is too heavy. I have found it to succeed only where rainfall is about 20 inches with irrigation at intervals. I have this year put in besides the above, groundnuts, gram, ginger, and a few other minor products ; it is too early to harvest but I shall be glad to send you the results in about 2 months I should mention that the rubber is planted 30 feet between the rows to enable catch crops to be grown.

C. D.

THE MANAGEMENT OF A RUBBER ESTATE.

M. SYDNEY PARRY.

Most people, I presume, regard the management of a rubber estate solely from the local point of view, i.e., they think of the work to be done by the planter on the spot. These same people doubtless regard a Director of a rubber company merely as they regard an M. P.—a person who draws £400 a year, talks and votes, signs papers. They forget, however, that the M. P. as well as the Director, has many arduous duties, often very technical, responsible ones, which in the case of M.P.'s are entirely unpaid, and proportionately unknown, e. g., Technical Committees of the House of Commons.

The beginning of many a rubber company is with its directorate—I am referring to the balmy boom days—so that properly speaking, the papers on the management of an estate should begin with the duties of a board in relation to it.

What in fact has a board to do besides sign cheques, dividend warrants, pass transfers, and sign and seal share certificates? The board, in addition to these formal duties, has many questions of policy to decide, how much is to be felled, whether tapping should be temporarily suspended, whether crops should be sold forward, whether a costly scheme of subsoil drainage should be undertaken, or whether a scheme of water supply should be laid down; most of these points requiring some degree of technical knowledge, and an understanding of local conditions A typical agenda of a board meeting embraces the following points:—

(1) Consideration of the financial condition of the company.

(2) A statement showing how much crop has been harvested, how much sold and at what price. Attached to the same schedule there is usually a statement showing how much has been spent on capital and revenue account, and from this statement a director should know approximately what profit is being made.

Should the company not be in a bearing stage, the statement shows how much has been spent on felling, cleaning, and planting, drainage, buildings, etc,

It may be here stated that each year estimates are drawn up by the local management, which have been in the first place checked, and controlled by the local agents, or visiting agents. These estimates are submitted for the board's decision, and the expenditure has to be carefully examined and compared with the estimates.

Though to a large extent the board must be influenced by the opinion of its local management, it still has the power of deciding how much is to be opened, at what distance trees are to be planted, the nature of the buildings to be erected, i.e., whether they are to be of a permanent character, e.g., whether steel and corrugated iron cooly houses are to be built, which it is assumed will last a life-time, and save depreciation, or whether wooden houses and attap (a kind of palm) roofs, which require renewal every three or four years. When the estate is nearing the tapping stage decisions have to be taken on the rival methods of basal V.S., half herring-bone, etc. As a corollary methods of curing have to be decided, which involve the ordering of factories, the erection of engines, machinery, etc.

Hospitals have nowadays to be built on all estates. These involve again decisions as to their nature, their situation even often comes up, the opinions locally differing at times.

(3) The consideration of the Eastern correspondence since the last board meeting. The length of time taken over this item on the agenda depends on two points:

(a) The efficiency of the chairman;

(b) The competency of the secretary to "devil" and set out clearly the points arising out of the correspondence, requiring decision.

Hours are sometimes wasted by an inefficient or over-worked chairman, who has not read his correspondence, and who consequently asks various questions which he should have already informed himself on.

The secretaries or secretary are too often responsible for long meetings. Some secretaries are "pernickity," cavil over every item; others, ignorant of the local conditions, advance points which the technical man on the board has to explain and upset.

An extensive knowledge of boards leads me to prefer chairmen who know their subject, and go direct for the points under discussion, having already made up their own minds. I prefer, too, the "pernickity" secretary to the careless, ignorant one.

(4) Transfers and signing of certificates.

This on the face of it, seems a very ordinary simple thing. It varies, however, very much, and is not so easy as it looks, especially when dealing with companies whose shares are partially held on the Continent. It is but human to die, and questions of probate duty for Continental shareholders, and a technical knowledge of English law are often requisite. Bearer shares, an ingenious method of avoiding Stamp Duty when shares are quoted three times over their face value, demand careful attention, and owing to the exigencies of the Stock Exchange, a fortnightly meeting.

The above points on an agenda do not seem very long, but they cover a wide field.

The duties of a director also involve the engagement of managers, assistants. This in itself requires on the part of a director some fair knowledge

not only of local conditions, but also of mental psychology ; the director who has to interview a would-be employee must be able to judge his man. If he is engaging a doctor he must go into his qualifications, his ability to adapt himself to the needs of the East, "where the best is like the worst:" "Where there ain't no Ten Commandments." Or an engineer, how far whisky is the applicant's enemy, for, to continue the quotation, the East is indeed a place "Where man can raise a thirst."

The would-be assistant or an assistant must be capable of commanding respect, nor likely to succumb to all the vices so well put by that knowing man from the East whom I have quoted.

The duties of a director are therefore manifold, responsible and sometimes arduous, very often involving the temporary finding of monies to avoid the issue of debentures.

In all cases the chairman, and at least one other member of the board should have either been planters themselves, or if the chairman has not been a planter he should have made periodical visits to the East, seen the property of whose destinies he is arbiter, and study the condition of life under which his employees have to live.

Directors have to bear all the kicks if things go wrong, and it therefore behoves them to understand for themselves the conditions of the estate, and to be able to give a good account of their stewardship to the shareholders whom they represent.—INDIA RUBBER JOURNAL.

TREATMENT OF LORANTHUS.

F. T. BROOKS.

Certain persons have pointed out that these semi-parasites do not apparently cause much harm to rubber trees. This is because these troublesome plants have rarely been numerous in estates yet, but a few trees which I have seen heavily laden with them had evidently suffered severely. In England a single mistletoe on an apple tree does little harm but if mistletoes are allowed to develop with impunity the trees are greatly weakened and the crop becomes negligible in consequence. In the same way any considerable development of parasitic flowering plants on rubber trees would cause general weakening of the trees and a lessened output of latex. Hence it is unwise to allow these parasitic growths to develop on rubber trees and all branches bearing them should be cut out as soon as discovered. Care should be taken to cut back the branches well beyond the point to which the external creeping stems of these parasites extend. In the species of *Loranthus* under consideration these creeping stems give off suckers every here and there which form the means of attachment to the host and the channels by which certain food substances are obtained. The suckers are of two kinds—those which penetrate the tissues of the host to the wood and those which do not pass beyond the bark, many of the latter in fact being merely adhesive discs loosely attached to the exterior. Suckers which penetrate the wood often become much swollen and the stems of the host in the immediate vicinity are also abnormally developed, the whole producing a knob of hypertrophied tissue. These parasites travel along the host by means of stems which creep over the exterior.

Many kinds of *Loranthus* are very common in the tropics and any one species usually grows upon several different kinds of hosts. One species of *Loranthus* found on rubber trees has also been seen on the *Melastoma* which is one of the commonest shrubs of the roadside and of waste places in this country.

These semi-parasites are disseminated by means of birds which deposit the seeds on the branches of trees and shrubs. As stated in the February number of the AGRICULTURAL BULLETIN these troublesome plants are much more likely to develop on trees which are in poor condition or which throw little shade than on those which have a dense leafy canopy.

In this connection it may be mentioned that harmless epiphytic plants on coconut and rubber trees are sometimes mistaken for dangerous parasites. Quite recently a number of coconut palms were thought to be seriously affected by the common epiphytic fern *Drymoglossum* which was growing in considerable abundance on the stems. This fern, however, is harmless for, like other epiphytes, it does not penetrate the interior and so does not withdraw nourishment from the plant to which it is attached. Trees are not adversely affected by the many different kinds of epiphytic ferns and flowering plants which often grow upon them in tropical countries; on the other hand parasitic flowering plants like *Loranthus* which penetrate the interior of the plants to which they are attached cause considerable damage to their hosts.—AGRICULTURAL BULLETIN.

THE MANKETAN MELON.

This variety of melon, according to MR. W. J. LAMONT of the Cape, is reported to have come from the arid parts of the North of the Colony. It is oval-shaped and characterised by a distinct pattern on the rind. It is green at first and becomes white as it ripens. Under favourable conditions the fruit attains to 50 lb.

Planting may be done in hills (2 or 3 seeds in each) 9 feet apart, and the seeds buried about 2 inches below the surface. At this rate 2 or 3 lb. of seed will suffice for an acre.

Harvesting is done when the vines begin to wither. Planted in November the crop could be gathered in May. At Grootfontein the yield secured from one acre was 50 tons.

Well matured fruit if carefully stored have been known to keep in good condition for 18 months after harvesting.

On irrigated land this melon stands drought well and with 2 waterings—though the rainfall was only 3 inches during the growing period—the crop as stated was as much as 50 tons.

The feeding value as shown by DR. J. LEWIS, Analyst, Grahamstown, is as follows:—Water 93·32, fat ·20, protein ·87, carbohydrate 3·35, crude fibre 1·72, ash ·54.

Seeds of this melon have recently been distributed among local members of the Agricultural Society.

C. D.

COCONUTS.

NEW MARKETS FOR BRITISH COLONIAL AND INDIAN COPRA.

IMPERIAL INSTITUTE TECHNICAL INFORMATION BUREAU.

Large quantities of copra have been exported during recent years from British Possessions to Germany and Austria-Hungary, and as this trade has totally ceased owing to the war it is necessary to consider the question of finding other markets for the produce.

The following table shows the imports of copra into Hamburg and Austria-Hungary during 1913 and will give some indication of the extent of the total trade and of the share of British Possessions. Hamburg is the chief centre of the German oil-seed crushing industry, and it is probable that the shipments of copra to that port practically represent the total German imports.

Imports of Copra in 1913 to Hamburg and Austria-Hungary.

	Quantity metric tons (2,204 lb.)
Hamburg.—Imports from all sources ...	230,395
,, ,, British Possessions ...	124,434
Austria-Hungary.—Imports from all sources ...	33,604
,, British Possessions ...	29,177

The details of the imports from the British Empire are as follows :—

Imports of Copra in 1913 to Hamburg and Austria-Hungary from the British Empire.

	Hamburg metric tons (2,204 lb.)	Austria-Hungary metric tons (2,204 lb.)
United Kingdom	225	—
British Central and South America	195	—
British Africa	(not given)	774
British East Indies	112,341	22,104
Australia	10,653	6,299
British South Sea Islands ...	1,020	
	124,434	29,177

These figures are not quite accurate and complete. Some imports from British West Africa reach Hamburg but are not separately shown in the returns for that port. The imports from Australia to Austria-Hungary include 608 metric tons from British Australia and 5,691 metric tons described merely as from Australia, which may include some of the foreign possessions in the Pacific. The figures are however probably sufficiently accurate for the present purpose.

The quantity of British copra for which a new market must be found may therefore be taken as about 153,611 metric tons.

It seems likely that a considerable proportion of this can be taken by the United Kingdom. The copra imported into Germany and Austria-Hungary is used for the production of oil (coconut oil) and feeding cake (coconut cake). The quantity of coconut oil exported from Hamburg in 1913 amounted to 40,966 metric tons of which 30,236 metric tons was sent to the United Kingdom and 5,261 metric tons to Norway and Sweden, the next largest purchasers. Copra is already expressed for oil in the United Kingdom and coconut oil is made both in Ceylon and India. There appears to be no reason therefore why the coconut oil which is imported to the United Kingdom from Hamburg should come in this roundabout way. The oil might be expressed in Ceylon or India and shipped direct to the United Kingdom or the copra might be exported to the United Kingdom and treated here instead of in Hamburg.

Further, the Trade Returns for the United Kingdom show that in 1913 this country also imported about 18,600 metric tons of coconut oil from foreign countries other than Germany. The total imports of foreign coconut oil to the United Kingdom in 1913 therefore amounted to about 49,000 metric tons, corresponding to about 82,000 tons of copra.

It is moreover certain that from all these foreign countries which export coconut oil to the United Kingdom, and especially from Germany, considerable quantities of coconut oil also reach this country in the form of margarine, vegetable butter and prepared fats and foods of various kinds. No definite figures can be suggested for the amount received in this way.

It is clear from the foregoing statement that considerably more than half of the British copra hitherto exported to Germany and Austria-Hungary could be taken by the United Kingdom, either in the form of copra or coconut oil. Ceylon and India produce both copra and coconut oil so that these countries could probably divert their supplies in either form to the United Kingdom.

In addition to the possibility of finding a market in the United Kingdom there appears to be a considerable chance of the British Possessions securing a share of the French import trade in copra. In 1912 the total imports of copra into France were 153,506 metric tons. Of this total 19,691 metric tons came from British Possessions, and 10,321 metric tons from French Colonies. Of the remainder 43,422 metric tons came from the Dutch East Indies and 72,964 metric tons came from the Philippines. It ought to be possible for Ceylon, India and the Federated Malay States to compete on favourable terms with the Dutch East Indies and the Philippines for this trade. There also seem to be considerable possibilities of developing an export trade in copra with Denmark, Scandinavia and Russia, and possibly with Holland.

In the case of the United States, the imports of copra in 1913 amounted to 15,548 metric tons of which 10,674 metric tons came from the Philippines and the rest mainly from French, British and German Possessions in the Pacific. The imports of coconut oil to the United States amounted in 1913 to 22,915 metric tons of which about 18,000 metric tons came from Ceylon, India, the United Kingdom and Australia, and the rest chiefly from France, Germany and the Philippines.

COCONUT CAKE AS FOOD FOR STOCK.

The coconut meal used in animal feeding consists of the dried and ground flesh of the coconut from which the oil has been extracted. The particular sample used in this experiment had the following composition (per cent.) :—Water, 9·00 ; protein, 19·35 ; carbohydrates, 48·00 ; fat, 9·12 ; fibre, 8·64 ; and ash, 5·89 ; so that it contained rather less protein and fibre and more carbohydrates than the average of German samples. The food chosen for comparison was gluten feed, and this contained less ash and fat, rather more protein and decidedly more carbohydrates than the coconut meal.

Digestibility experiments with sheep showed the following amounts to be digestible (in lb., out of 2,000 lb.—coconut meal is given first) :—Protein 347·6, 397·2 ; carbohydrates 829·0, 949·6 ; fat 187·4, 46·6 ; fibre 40·4, 118·6 ; ash 75·4, 66·5 ; and total digestible matter 1479·8, 1578·5. If the fat is converted into its starch equivalent the coconut meal would seem to furnish 1,705 lb. and the gluten feed 1,634 lb. of digestible matter per 2,000 lb. fed.

The cows were selected and the comparative value of the two foods for milk production was ascertained. The basal ration consisted of hay and bran, five cows being fed on coconut meal and five on gluten feed, these two foods afterwards being changed over ; both foods were fed at the rate of 3·68 lb. per head per day. Substantially the same amounts of milk were obtained from the coconut meal as from the gluten feed, but slightly more butter fat was secured from the former.

It is believed that coconut meal is fully equal to gluten feed in nutritive value, although it is doubtful if it exceeds it. German observers consider it particularly desirable for dairy animals in amounts of from 3 to 4 lb. per head daily, and it has been shown to increase somewhat the fat content of the milk. Fed in excess of 4 lb. it is held to make too hard a butter.—JOURNAL OF THE BOARD OF AGRICULTURE.

SULPHURIC ACID AS A WEED KILLER.

After trials of sulphate of copper, sulphate of iron, and sulphuric acid in varying strengths, the author concludes that sulphuric acid in 6, 8 or 10 per cent. solutions (the degree of strength depending upon local conditions) is the most satisfactory spray to use. The solution was applied at the rate of 107 gallons per acre and killed most of the annual weeds, but it did not perceptibly retard the growth of wheat although the lower leaves were killed. This solution had the advantage of being effective in 3 or 4 hours, while the other solutions required 3 or 4 days. The sulphuric acid solution also had a fertilising effect on the soil.—JOURNAL OF THE BOARD OF AGRICULTURE.

RICE.

RICE CULTIVATION IN SPAIN.

DR. BUTLER, Imperial Mycologist, as delegate from India to the recent International Rice Congress at Valencia, has contributed an interesting account of the cultivation of rice in Spain to the October number of the AGRICULTURAL JOURNAL OF INDIA. It is not generally known that Spain is the second largest rice growing country in Europe with 96,000 acres under the crop, against Italy's 360,000. Rice is also cultivated in Bulgaria, Greece and France. The chief rice-growing province in Spain is Valencia. The system of cultivation in vogue is more akin to that of India than in other parts of Europe, and DR. BUTLER states that many of the practices followed and in particular that of transplanting, unknown elsewhere in Europe, are to be traced to the presence, at one time, of the Moors in Spain.

The following details will be of interest to our readers:—In preparing the land for sowing, the fields receive a first working while in a muddy state (say in January). This is done with harrows, derived from the Acme and Disc harrow, specially calculated to cut up and bury weeds (chiefly *Leersia Oryzoides*). The field is now dried off and receives the most important working of the year, viz., a thorough ploughing with a heavy draft inverting plough. Not long since the implement known as the "forcat" very similar to the paddy plough (*sans* mould-board) was in use, and the cultivators of Valencia consider the introduction of the inverting plough one of the greatest advances made in their hereditary occupation: and indeed its effects have been far-reaching. Horses are used for these heavy implements, and to meet the requirements of the rice cultivator it became necessary to improve the local breed of horses by the infusion of French blood in order to produce a more powerful type of animal. The object of this ploughing is to leave the soil exposed to the air in large masses and to dry it to as great a depth as possible. It is seldom, however, that a depth of 5 or 6 inches is exceeded on the heavy soils. In May, a few days before transplanting, the water is run into the field and a final pudding with the Draga (a modified acme harrow) or with horses alone is given to destroy weeds and reduce the permeability of the soil.

The fields are very heavily manured with green-manure but more usually with a mixture of sulphate of ammonia (40%), superphosphate (54%) and sulphate of potash (6%) at the rate of 600 to 800 lb. per acre. Guano is also used in some parts at about the same rate. Nitrates of potash and soda are considered unsatisfactory. The value fo Manganese (found in Japan to increase the yield) it is suggested is due to its action as a catalyser, resulting in better oxygenation of the roots under certain conditions.

Seed beds are located on higher land than the fields and are some many miles away in localities selected as specially suitable. The relation of seed bed to field is 1 to 10 or 12. The transplanter works backwards, as in India, and plants clumps of 3 to 5 seedlings in holes 8 to 10 inches apart.

Six men will transplant a hectare (2·47 ac.) in a day. Harvesting is done with a sickle and the grain trodden out by horses or the labourers themselves with the help of a wooden fork for turning over the straw. The chaff is separated with the aid of the wind. Thrashers and winnowers are only now coming into use.

The following comparative figures quoted from the BULLETIN OF AGRICULTURAL STATISTICS show the position of Spain as a rice producing country:—

Country	Area under rice in acres.	Production in tons.	Yield per acre in lb.
Spain	96,000	246,000	5,700
Italy	360,000	534,000	3,300
Egypt	254,000	375,000	3,300
Japan	7,393,000	7,026,000	2,100
United States	827,000	517,000	1,400
India	70,580,000	28,167,000	890

The average for India must be accepted as a very rough one as there are many districts in which the yield per acre is quite double that given. It will be seen that the average yield per acre in Spain is about double that in Italy and over 6 times that in India. The excess over Italy is attributed to transplanting, and over India to heavy manuring and the use of better implements. It may be added that both Italian and Spanish authorities agree that the continued cultivation of a particular variety, without selection, in the same locality leads to degeneration, and that one of the most important factors in rice cultivation is the introduction of new varieties obtained by importation and selection. Japanese varieties are doing well both in Italy and Spain.

C. D.

FISH MANURE ON PADDY.

THE MADRAS AGRICULTURAL STUDENTS' UNION JOURNAL for November last gives details of an interesting experiment in the manuring of paddy with fish by N. THEVAN at Erode.

An acre field was dressed with 5 bags of the fish manure and planted with single seedlings raised in a nursery. The crop secured was much better than one raised with the use of *Tephrosia purpurea* as green manure.

We quote the following particulars:—

In ordinarily planted fields which received *Tephrosia* leaves costing Rs. 20 the yield per acre was 10 salagais

In an acre of field which received fish manure costing Rs. 14 per acre the yield per acre was 13 salagais

Thus the gain per acre in the cost of manure was	Rs.	6-0-0
The value of increased yield per acre, 3 salagais, was	,,	18-0-0
Total	Rs.	24-0-0

A salagai of paddy weighs 160-168 lb.

C. D.

VARIETIES OF PADDY.

It is well known what an extraordinary number of varieties of paddy exist, for instance, 131 different kinds were grown on the educational plots at Coimbatore last year. Work on the district farms as far as varieties are concerned has hitherto proceeded as a general rule on two main lines, (*a*) the introduction and trial of varieties from other centres; (*b*) the improvement of the local strain by seed selection.—

(*a*) The testing of varieties from other centres has been mostly carried out at Samalkota, Coimbatore and Palur. At Samalkota the search has primarily been directed to find a variety which could be grown as second crop immediately following on the first as is customary in most districts where two crops are grown. In Godavari a month or more during all which time water is available, is allowed to elapse between the harvest of the first crop and the sowing of the second. It was to utilize this period that these trials were started in 1908-09, and have been continued ever since. So far nothing has been found to satisfy these conditions. Fifteen varieties were tried last year but only three grew at all and only one gave even a moderate outturn. Varieties of paddy when transported to other districts frequently lose their special characteristics and it requires trial to determine whether any special variety is likely to prove an acquisition to a district. So far Tanjore Sirumani and Tinnevelly Poombalai promise to be useful both at Coimbatore and South Arcot.

(*b*) At nearly every one of the farms selection and propagation of single selected strains are in progress and at Coimbatore the bulk crop is from a single plant selection. At Samalkota single plant selections have also been made, but as cross fertilization does occur to a limited extent the separation of *pure* distinct strains will be a matter of time. But the most promising strain so far separated is the one referred to in last year's report at Palur. It has this year given an acre yield of 2,528 lb. against the ordinary garudan samba yield this year of 2,218. If it maintains this superiority again efforts will be made to spread it in the neighbouring villages.

SEED-RATE.

The reduction of the seed-rate for transplantation of paddy has been so consistently and regularly advocated that there is no need to refer to it at any length here. The whole of the wet land area at Coimbatore over 40 acres was transplanted from 2·11 acres of seed-bed on which 730 lb. of seed had been sown. This works out practically to 16 lb. of seed for each acre transplanted, whereas if the ordinary local practice were followed 106 lb. would have been used, and the returns from the land have not decreased.

The average yield over the whole 40 acres of wet land area of the central farm was 2,572 lb. of grain as compared with 3,762 lb., the highest revealed on ryots' land in the crop cutting experiments, at Samalkota the average over a similar area was 3,037 lb. as compared with 2,390 lb, the highest figure recorded for ryots' land in the Godavari this year.

MANURES.

Considerable attention is being paid at Samalkota, Coimbatore and Manganallur and to a less degree at Palur to the questions connected with the manuring of paddy. It may almost be accepted now that the most

suitable form in which to apply nitrogen to paddy is in organic combination whether as green manure or as cake. It is in one of these forms that nitrogen is now always applied on the farms to this crop. It is unfortunate that the wet lands at Coimbatore are so unsuited for experimental work as it requires much repetition there before results can be accepted with any certainty. But the results of five years' continuous work at Coimbatore, nine years at Samalkota and one year at Manganallur are all in substantial agreement. At Samalkota an average increased yield of 810 lb. of grain per acre per year over nine years has been obtained by applications of castor-cake *plus* superphosphate, at Manganallur an average acre increase of 630 lb. of grain has been obtained by an application of green leaf *plus* superphosphate, at Coimbatore a complete manuring with an extra dose of superphosphate has given an increased average yield per acre of 660 lb. per year over five years. The results are also in accord with chemical analyses of the soil. In all these cases also the increases in the yield of straw has been greater proportionately than the increase in the yield of grain. A careless observer using these manures might think that all the manure was going into the straw ; yet these figures show that the increase of grain is decidedly appreciable. It would not be reasonable to push these figures too far as many questions connected therewith, e.g., on the financial side, on the form in which to supply phosphate, though so far all indications point to the use of superphosphate, require to be worked out. If the prices of paddy continue to rise a little more the extended use of such fertilizers should become a matter of regular business for such land and crops.

GREEN MANURING.

Considerable interest will, for some years, circle round the action of green manuring, since there are many problems connected with not as yet understood. Of all the essential elements which a farmer in the west buys for manurial purposes it is nitrogen which is the most expensive, but generally speaking paddy cultivated under swamp conditions utilises nitrogen presented to it in organic combination much more thoroughly than when in combination with minerals. This is most fortunate for the tropical farmer, for green leaf and green manuring are much cheaper than nitrates, etc., in fact there is no comparison, but it is also obviously more difficult to grow and manage a green manure crop than it is to distribute over a field a certain number of pounds of nitrate. Thus it was reported last year, that on the heavy delta soils at Manganallur the application of a green manure crop in the ordinary way on these fine soils had temporarily interfered with the drainage and the paddy crops had failed. MR. SAMPSON had surmised that in this year the fields would probably show the benefit of the green manure crop they had received, consequently no further manure was given to them. The figures are so striking as to merit repetition in full.

PADDY YIELD PER ACRE IN POUNDS.

Field Number.	1911-12. Treated in the ordinary method prevailing in Tanjore.	1912-13. Green manure applied, crop failed.	1913-14. No further Manure added.
1	1,149	205	2,251
2	1,066	164	2,332
3	1,206	253	1,963

Other experiments were laid down to try other methods of managing the green manure but whilst none of the paddy crop failed yet the results are too inconclusive at present to draw any inferences. The general effect of seed selection, and green manuring in maintaining the fertility of rice land is indicated from the figures of Palur which station was opened in 1906-07. The average yields of paddy per acre over the whole farm in 1907-08 and in 1909-10 and in each succeeding subsequent year have been 1,777 lb., 1,751 lb., 2,791 lb., 2,838 lb., 2,934 lb., 2,639 lb. and in the latter years as it has all been transplanted with single seedlings another 70 lb., per annum per acre have been saved in seed. The last year was not a favourable one on account of the floods.—MADRAS AGRICULTURAL DEPARTMENT REPORT.

WHAT IS BRUSOME?

Brusome is regarded as one of the most serious diseases of rice in Italy in view of the great loss of crop involved, but little has been known as to the exact nature and the cause of this so-called disease though the phenomena connected with it are familiar wherever rice is cultivated.

DR. BUTLER, Imperial Mycologist of India, is of the opinion that a number of distinct affections have been confused under the same name. The resultant condition as far as the crop is concerned is that the grain fails to reach maturity, when it is locally described as "boll," and it is suggested that the name be confined only to cases where this condition *cannot* be ascribed to the action of parasitic organisms.

In the discussion at the recent Rice Congress at Valencia general agreement was shown in considering brusome as a physiological degeneration hastened by the action of ill-defined external conditions, climatic as well as cultural. In Spain the prevalence of westerly winds are considered a predisposing cause : in India the effect is ascribed to the south winds. Other alleged predisposing causes are the deficiency of oxygen in the water, impoverishment of the soil, sudden variation of temperature, etc.

The experience in Italy is that the introduction of exotic varieties of paddy helped to allay the trouble, and the Director of the Vercelli Station believes that in this means a satisfactory method of fighting the disease has been found. Where new varieties (chiefly Japanese) have been introduced, and care is taken not to grow one variety too long in the same fields and under the same conditions, brusome is said to have lost its terrors. This is without doubt a most important announcement which DR. BUTLER makes in his valuable report on the proceedings of the Congress.

C. D.

TOBACCO.

CIGARS FROM JAFFNA, CEYLON.

REPORT OF THE IMPERIAL INSTITUTE, LONDON.

The three samples of Jaffna cigars which are the subject of this report were forwarded by the Director of Agriculture at Peradeniya with letter No. 3,968 of the 26th September, 1914. It was requested that the cigars might be submitted to a firm of merchants for an opinion as to whether they would be likely to find a market among sailors and others in the United Kingdom.

The three samples are as follows :—

No. 1	consisting of	100	cigars	weighing	24	ounces.
No. 2	,,	100	,,	,,	13	,,
No. 3	,,	100	,,	,,	10	,,

All the cigars are made of tobacco of similar quality, and practically the only difference between the three kinds is their size, which is indicated by the difference in weight per 100 cigars mentioned above.

The following description may be taken as applying to all the samples.

The cigars are wrapped with a fairly thin leaf, which varies in colour from dull brown to very dark brown, and shows many "burns," some of which have degenerated into holes. The "bunch" or "binder" consists of coarse leaf, which is nearly black on the inner binding surface. The filler consists of very coarse leaf with prominent veins, and of a dull brown nondescript character.

The cigars have a distinctly ammoniacal odour, and reddened litmus paper suspended near them rapidly turns blue.

All the cigars are rolled too tightly and are consequently difficult to smoke. They burn fairly well and hold fire moderately well, but on smoking they show a heavy black "lip" and leave a rather dark grey ash, which is loose and flocculent. By the time the cigars are smoked one quarter through, they become soft and sodden, and acquire a most unpleasant odour of stale tobacco smoke.

It is known that a special preparation is mixed with the leaves in rolling them into cigars, and to this some of their peculiarities are no doubt due.

COMMERCIAL VALUE.

These cigars would have no commercial value in this country, for the following reasons. The duty on cigars imported to the United Kingdom is 7*s.* per lb. This amounts to the following sums per cigar for the samples now under consideration :—

No. 1	...	1·26*d.*
No. 2	...	0·68*d.*
No. 3	...	0·525*d.*

Adding to these sums the cost of each cigar, calculated from the retail prices per 100 quoted in the letter forwarding samples, the price, per cigar, delivered in the United Kingdom, will be as follows :—

No. 1	...	1·74*d.*
No. 2	...	0·92*d.*
No. 3	..	0·685*d.*

It is pointed out in the letter that quotations for wholesale quantities would be lower than the prices given there, but against that reduction must be placed the cost of transport of the cigars to this country. It seems quite certain that even at wholesale rates the price at which these cigars could be delivered here would prevent their being sold at a profit in this country.

It must be remembered that the United Kingdom draws its supplies of cigars and cigar tobaccos from the best tobacco countries in the world, and that for a variety of reasons tobacco of good quality is cheaper here (duty apart) than in any other country that does not itself produce all the tobacco it uses.

Of the three products now under report No. 1 only would be regarded technically as a cigar. It could not be sold retail in the United Kingdom at less than 2*d.* per cigar, and at this price it would have to compete with cigars manufactured in the United Kingdom from American, Dutch, East Indian, Japanese and other cigar tobaccos which are of a quality that meets European tastes. Further, large quantities of cigars of fair quality are now imported from the Continent, Manila, Mexico and elsewhere, which can be sold at prices ranging from 1½*d.* to 1¾*d.* each.

This cheap cigar industry can only be carried on so far as this market is concerned in large, carefully conducted factories, where expert skill is available for the choice of the tobacco to be used, and where the weight, size and moisture-content of the cigars can be carefully regulated to bring the duty, per cigar, to as low a point as possible, without trespassing on the legitimate requirements of the consumer.

The same arguments apply with equal force to samples 2 and 3. These would not be regarded technically as cigars in this country ; they would have to compete with a great variety of products known as "cigarilloes," "whiffs" etc., which are now being made from the waste tobacco from cigar factories. These articles are sold here at prices ranging from ½*d.* to 1*d.* each, and the cheapest of them contains tobacco of good quality.

The foregoing remarks apply especially to the question of finding a general market for these Jaffna cigars in the United Kingdom. It would be far more difficult to sell them to the class of consumers suggested in the letter accompanying the samples. Men engaged in sea-faring are allowed to bring into the United Kingdom ports 50 cigars, duty free, so that they do not normally purchase cigars on which the heavy British duty has been paid.

To sum up : these Jaffna cigars are quite unsuitable for the British market, and probably also for any European market. The heavy duty on cigars in the United Kingdom makes it practically impossible to sell here any kind of cigar at less than 1½*d.* 2*d.* each. At this price the consumer has a great variety of cigars made from carefully blended tobaccos of fair quality to choose from.

Some years ago, during a visit to Jaffna, the Director of the Imperial Institute expressed the opinion that tobacco might be grown and cigars manufactured there of a quality suitable for export to Europe, similar to the cigars of Southern India. In order to effect this the growth of suitable tobacco is not the only or even the chief question. Curing and preparation will also require investigation.

NICOTINE IN THE BY-PRODUCTS OF THE CULTIVATION OF TOBACCO.

E. CHUARD AND R. MELLET.

Through the investigations carried out by the writers, in 1911, into the variation of the proportion of nicotine in the several organs of the tobacco plant during the course of development, it was ascertained that the offal of the crop as it is raised in Switzerland contains considerable quantities of the alkaloid. This waste consists of tips and axillary shoots before the leaves are gathered; stems, roots and shoots after the leaves are gathered. This waste, when used green, in order to avoid the loss of nicotine due to desiccation, is an important raw material for the preparation of the titrated solutions used as insecticides.

Experiments were undertaken in 1913 with a view to ascertaining the possibility of increasing the yield of nicotine in these waste products by suitably modifying the methods of cultivation of the plants and their treatment after the leaves had been gathered, without damaging the quality and the quantity of the chief product; the following methods were tried; (1) allowing the axillary shoots to grow instead of removing them as they appeared; (2) at harvest time gathering only the largest leaves, leaving in the ground all the stems provided with the recently formed shoots; (3) treating with nitrate of soda the plants thus partially deprived of their leaves

From the analysis of the plants thus treated the writers draw the following conclusions:—

1. The plants not deprived of their shoots are on the whole less abundant producers of the alkaloid (1·305 gm. nicotine per untouched plant against 1·891 gm. in the others), and this independently of the serious harm done, by not removing the shoots, to the quantity and quality of the main crop.

2. The yield of nicotine of the plants left in the field after the harvest with the small shoots recently formed in the axils of the large leaves is much superior (0·942 gm. nicotine per whole plant against 0·432 gm.) to that of the plants completely stripped.

(3). Treating with nitrate of soda does not regularly modify the relative content of the different organs of the plant, but increases the absolute production of alkaloid per individual by favouring its growth (with nitrate 0·739 gm. nicotine per completely stripped plant and 1·288 gm. per partially stripped one). Thus nitrate is not a direct producer of nicotine (A. Mayer).

The writers conclude that it would not be advantageous, even from the point of view of the production of nicotine, to allow the growth of the axillary shoots which are formed before picking, instead of removing them as they appear, but that the returns from the utilizable by-products (according to the methods of cultivation adopted in Switzerland) may be considerably increased by giving nitrate of soda to the plants that are left standing after the harvest, during which they are deprived only of their large leaves.—

MONTHLY BULLETIN.

FRUIT.

THE PAPAYA.

Bulletin No. 32 of the Hawaii Agricultural Experiment Station deals with the Papaya, and contains the results of investigations at the Experiment Station and a consideration of the literature on the subject.

In view of the great popularity and food value of the fruit it is interesting to find an analysis of it, which is as follows :—Water, 90·75 ; protein, 0·80 ; fat, 0·10 ; fibre, 1·09 ; nitrogen free extract, 6·32 ; ash, 0·94. A number of recipes for the serving of the fruit are given but no reference is made to the excellent crystalised conserve that can be prepared from it. One can hardly understand the seeds being eaten "as a delicacy" or even as a "quencher of thirst!"

The section on papain affords some useful information. Those closely in touch with the manufacturing end of the business estimate the value of the imports of papain into the United States at from Rs. 225,000 to Rs. 240,000 per annum. The price paid per lb. is said to vary from Rs. 4·50 to Rs. 9. The main sources of supply are the West Indies and Ceylon. In the former Colony the chief producer was first Jamaica and subsequently Montserrat whose preparation is said to bring better value than that of Ceylon. Prices are now, however, somewhat low ; but there should be a demand for a more carefully prepared product in place of cheaper grades adulterated with boiled rice and other foreign substances.

In this connection the following notes on the method of collecting and preparing the juice ought to prove of interest. The juice is usually only obtained from the fruit. The best time to tap is when the trees are young and during warm weather after rain : the flow being most abundant in the early morning. Incisions need not be more than ½ in. deep and about ½ in. apart. Tapping may be repeated several times at intervals of three or four days. Non-metallic instruments and utensils should only be used.

The juice must be dried promptly. This is generally done in the sun but may also be done in a drier at a low temperature, the coagulated juice being spread upon linen stretched upon frames.

As regards yield the estimate of 1 lb. of dried latex per tree per annum is considered rather high. The coagulated material is reckoned to give 25 per cent. of its weight in dry powder which will still contain 6 to 10 per cent. moisture, and of this dry powder about ⅙th in papain proper.

No less than 13 forms of the Papaya tree are recognised, the basis of differentiation being one of sexual relation. These forms are, however, not constant. For instance the fruiting of the male has been found to take place most freely in cool climates and high altitudes, while it is rare in hot places. The topping of the tree appears to promote the fruiting capacity of a so-called male tree. We have had the same experience, in bringing about this change, while the production of seedless fruits (parthenocarpy) by certain trees has also been recorded in Ceylon.

In considering the ideals in breeding the papaya, the authors of the bulletin do not distinguish between the ideals for the dessert fruit type, and those for papain production, although the two do not correspond. It is a well recognised fact that some forms are much more laticiferous than others. From the local standpoint the two important cultivated types are the large round and large long, and the former is preferred to the latter. Their general characteristics are :—(1) large round, bright yellow flesh, flavour rich and sweet ; (2) large long, flesh pale, flavour watery and insipid. The long variety is generally associated with the presence of much milky juice which is considered objectionable in a dessert fruit. A form bearing somewhat irregular shaped fruits (the seed of which originally came from Bangalore) has a marked camphoraceous flavour. What is generally regarded as our native papaw is a prolific variety bearing small sweet fruits with reddish flesh and an abundance of seeds.

C. D.

THINNING OF PAPAYA FRUITS.

The fruits of the papaya are borne round the stem in such a way that they interfere seriously with each other's growth. It is therefore best to remove a certain number of fruits to allow the rest to develop better.

With this end in view 10 plants in the Ganeshkhind Gardens, Poona, were operated on in September, 1910, one unthinned plant being left for control. The process caused much greater development of the individual fruits, one being as heavy as 8 lb., and the remainder ranging from 6 to 8 lb. A dealer offered 4 annas each for the thinned fruits. The unthinned tree had many fruits which had crowded and deformed one another. A similar experiment was tried under the writer's (L. B. KULKARNI) advice in a cultivator's field and the results were equally satisfactory.

In 1912 the experiment was again systematically conducted in the Ganeshkhind Gardens, Poona, twenty plants being selected and labelled A and B. The ten plants labelled "A" were thinned and the ten plants labelled "B" were left unthinned as controls. The variety used was Ceylon. The following table will show that the average number of fruits from the thinned plants is much less than that of the unthinned, but the average weight is correspondingly greater. The estimate of the money value is based on a small number of fruits only which, when sent to the market, brought the following prices:—

Thinned.				Unthinned.			
No. of Fruits.	Price.			No. of Fruits.	Price.		
	Rs.	As.	P.		Rs.	As.	P.
4	0	5	0	3	0	2	9
6	0	3	6	16	0	13	0
—		—		5	0	3	0
10	0	8	6	24	1	2	9
The average price per fruit comes to 10·2 pies.				The average price per fruit is 9·3 pies.			

A. Thinned.				B. Unthinned.		
Plants.	No. of Fruits Removed.	Fruits Obtained.	Average weight of each fruit in ozs.	Plants.	Fruits Obtained	Average weight in ozs.
1	12	6	39·3	1	20	37·2
2	15	11	34·0	2	23	31·5
3	16	7	48·2	3	11	30·5
4	16	8	54·0	4	15	35·8
5	23	9	47·7	5	14	36·1
6	10	7	43·0	6	14	38·7
7	11	6	36·8	7	15	36·4
8	7	1	27·0	8	28	26·9
9	5	4	42·0	9	11	30·8
10	13	10	37·7	10	11	24·3
Avge.	12·8	6·9	40·9	—	18·2	32·8

The above results show that the increase of weight is not sufficient to compensate for the loss of fruits in the experiment under consideration. Another experiment gave the following results :—

Plant.	Fruits Removed.	Fruits Obtained.	Weight.
1	5	3	71·6 ozs.
2	6	7	65·0 ,,
3	7	3	52·3 ,,

Here the weights are greater but the fruits still fewer.

With a small number of, say, six good fruits per plant the experiment may pay ultimately when run on a large scale, *vide* the *Annual Report of the Government Horticultural Gardens Lucknow*, for 1912, where it is stated that an acre of land carrying 1,000 plants, each producing 6 to 10 fruits after thinning may give considerable profit to the grower. The difficulty is to hit on exactly the right amount of thinning to get the greatest weight compatible with the greatest number of fruits. This can only be obtained by practice and in the meantime it is recommended to remove only such fruits as are obviously going to be badly crushed.—AGRICULTURAL JOURNAL OF INDIA.

SOILS AND MANURES.

THE STORAGE AND USE OF SOIL MOISTURE.

This is the title of a valuable contribution to the subject of Dry Farming by MR. W. W. BURR of the United States Department of Agriculture, who while seeking to explain the principles governing the conservancy of water in soil, corrects certain erroneous ideas which have got abroad.

The storing of water in the soil necessitates first the getting of water into the soil and next preventing its escape. Now the getting of the water depends upon the condition of the surface soil where rain falls, as well as the nature of the rainfall.

It should be remembered that water runs off a dry hard surface more freely than from one which has been loosened by cultivation. In the latter case it soaks into the soil through the open spaces which have been produced by tillage. The extent to which soakage takes place will depend both on the type of soil and the character of the rain. Resistance to penetration increases as the soil becomes heavier or more clayey. Again as regards rainfall, the more rapidly the water falls the greater the "run-off." Torrential showers not only give no time for the water to sink but also help to clog the surface and reduce absorption. Therefore a cultivated surface will retain more water after heavy rain than an uncultivated one. The best kind of rain is that which is not so light as to merely wet the top layer of soil and be soon lost by evaporation, and not so heavy as to cause loss by "run-off," but sufficiently moderate to allow the water to sink down and be stored for future use.

The amount of water present in the soil when rain falls is also of importance. Where a soil is very dry at such times the water required to moisten it is so great that a first shower seldom goes below the top surface and the moisture is soon lost by evaporation unless followed by other showers. Where, on the other hand, the soil is originally moist, rain is quickly carried down.

The observations made by the author lead him to say that sod-land, which is generally hard and dry at the surface, absorbs less rain water than a cultivated (tilled) soil, i.e. one which is clean of grass and weeds. The difference usually also varies in direct ratio with the rate at which the rain falls. Where rain is heavy when it falls, the more the surface has been stirred the more water will it admit. It was found that as the result of a single shower, sod-land was wet to a depth of three inches while tilled land was wet to a depth of nine inches. Again in the field of lucerne which had not recently undergone tillage the rain had penetrated 7 inches, while in a newly ploughed field it had gone down fully three feet.

Soil water may be lost in three ways:— (1) by downward percolation (2) by surface evaporation, (3) by transpiration through growing plants.

It is seldom that there is enough water to allow percolation beyond the reach of the plant, and percolation does not take place until a soil is filled beyond its carrying capacity.

Surface evaporation on the other hand is a cause of loss even under the best system of cultivation, but it can be reduced to a minimum.

The evaporation of water rising up from below is most rapid when the surface is compact and moist and it should therefore be the object of the planter to loosen and dry up the upper layer and so retard the movement of water to the surface where it passes out as vapour.

A soil carrying a crop loses more moisture than bare soil inasmuch as water is lost by transpiration or exhalation through the leaves. The presence of weeds is therefore a source of loss. Weeds must always be regarded as the worst enemies of the planter who is cultivating under a limited rainfall, since crops are reduced to the extent they have been robbed of moisture by weeds.

To quote the words of the author "Cultivation is the one practical means that the farmer has for conserving moisture over a considerable area of land. It is by cultivation that the surface is put in condition to catch and hold the water until it can soak into the soil. Weeds are killed by cultivation and thus prevented from using the water which falls.

"Cultivation also checks the loss of water from soils by direct evaporation. Stirring the soil loosens the surface, hastens the process of drying the upper layer and decreases the points of contact between the soil particles, so that the water from below cannot readily reach the surface by capillary action. In other words, we purposely sacrifice the moisture in the cultivated surface layer in order to conserve that in the deeper levels."

The reader will it is hoped now clearly understand the principles governing the conservation of soil moisture. It is for the planter to apply the principles in his own practice according to his own opportunities and requirements. He must decide as to the most economical system of cultivation for him to adopt in endeavouring to put these principles into practice. The problems may differ with the circumstances of each case but the principles cannot change.

The application of the principles of storing water may be summed up in a word as follows:— The surface should be kept in a condition to catch the rains. It should be kept cultivated so as to make it loose in order to reduce evaporation to a minimum. Weeds should be kept down as far as practicable to prevent loss by transpiration.

But to bring his practices to the point of greatest efficiency it is essential that the planter should thoroughly understand the condition under which he is working, and how the principles are going to affect his practices. He must command a thorough knowledge of prevailing weather conditions, existing soil conditions and the nature and requirements of his crops. Then only can he satisfactorily work out a system for himself.

C. D.

THE EFFECT OF CAUSTIC LIME ON CERTAIN SOILS.

Investigations carried out on five soils of widely different types showed that the amount of caustic lime necessary to induce specific changes in the flora and fauna of the soil depends very largely on the character of the soil. The amounts of caustic lime necessary to effect reactions in each of the five soils tested were:—On light, sandy soil, poor in organic matter and in carbonate, 0·2 to 0·3 per cent.; on stiff clay loam, poor in organic matter but rich in carbonate, 0·3 to 0·4 per cent.; on an open sandy loam of an acid nature, 0·5 to 1·0 per cent.; on a rich well-dunged garden soil, 0·5 to 1·0 per cent.; while a light, sandy, organic soil, deficient in carbonate, failed to react even to applications of 1·0 per cent. of caustic lime.

Each of these soils, as well as many others examined, appears to absorb directly a definite amount of caustic lime, and, until these requirements are satisfied, the partial sterilisation does not set in. When this point has been reached there occurs an initial decrease in the numbers of bacteria followed by large increases, the larger forms of soil protozoa are killed, and an inhibition of nitrate production is caused. Lower doses than those required for partial sterilisation induce a temporary suspension of nitrification and a consequent accumulation of ammonia.

Caustic lime chemically breaks down some of the organic matter of the soil, as shown by the ammonia formed during periods when soil bacteria are quiescent; when, however, bacterial growth commences, there is a large increase in the rate of ammonia production.

The return in nitrogen, as ammonia and nitrate for each increment of lime applied, varies with the character and reaction of the soil and its carbonate content. On the average, and within a period of about 250 days, it amounted to approximately 1·0 per cent. by weight of the caustic lime applied. Chalk gave less return, apparently because of its relative inaction on soil organic matter.—JOURNAL OF THE BOARD OF AGRICULTURE.

INFLUENCE OF LIME ON SOIL BACTERIA.

F. MILLER.

The writer contributes to the discussion of the question already examined in various quarters as to the influence of the compounds of lime upon the multiplication and the vital activity of the soil bacteria. In the experiments the rather heavy soil of the experiment field of the Agricultural and Baterio-logical Institute of the University of Göttingen was used. The soil was taken from the field when it was damp; it was then sifted and thoroughly mixed. The additions were calculated on the dry earth. The quicklime was added in a finely pulverized state and well mixed with the soil. It contained only 4·16 per cent. Carbon dioxide. The soil under examination contained 2·02 per cent. of quicklime and 1·19 per cent. of Carbon dioxide. An addition of

5 per cent. quicklime made the soil noticeably warmer and additions of 1 and 5 per cent. increased the loss of water from the soil. The experiments led to the following principal results :—

1. Additions of 0·3, 0·5 and 1 per cent. quicklime caused at first a striking decrease in the numbers of bacteria and later an immense increase. The greater the addition of lime the longer the duration of the decrease, but also all the more intense the increase when it finally set in.

2. The addition of 5 per cent. quicklime hindered completely the growth of bacteria.

3. Quicklime in doses of more than 0·05 per cent. on loam rich in lime caused a reduction of nitrification. Doses of 0·01-0·06 per cent. in Bunter sandstone poor in lime have a stimulating effect in this direction.

4. Additions of quicklime up to 0·1 per cent. on sandy soils rich or poor in lime diminished the formation of nitrate from ammonium sulphate, and doses of 0·5 per cent. quicklime stopped this process altogether.—MONTHLY BULLETIN.

FISH MANURE.

Fish refuse and waste fish have long been used for manurial purposes. About fishing villages it has been the practice to use the heads and entrails of fish, together with the worthless, damaged or decomposing fish and the shells of shell-fish for application to the land. East Kent farmers especially seem very partial to waste fish as a manure, and the loads of sprats and of "five fingers" (star fish) occasionally obtainable are disposed of without difficulty. Its use in East Kent is not confined to hops—it has also been applied with great advantage to mangolds. The disadvantages attaching to the use of waste fish for manurial purposes are that a considerable proportion of the nitrogen present is lost as gaseous ammonia during putrefaction, and, further, that the material cannot be stored profitably for future use. At the large fishing centres, such as Hull, Grimsby, and Aberdeen, moreover, most of the waste fish cannot be utilised in this way, and as it soon becomes offensive, owing to its particularly penetrating and unpleasant odour, fish-manure factories have naturally sprung-up.

COMPOSITION.

Fish manures vary in nature and composition according to the class of material from which they are made, their purity and the method of manufacture. Their manurial value depends upon their content of nitrogen and phosphates; if the manures contain much fish bone the content of phosphates will be high and of nitrogen low, while if the manures contain much fish flesh and little bone the nitrogen will be high and the phosphates low. Usually, also, fish manures contain small amounts of potash and lime, and in cases also a good deal of salts, which is of little manurial value. A proportion of the

"fish manures" on the market in this country are, however, proprietary articles in which considerable amounts of potash and other substances have been added to the original fish manure.

The fish manures sold are usually finely ground and may be applied with any manure drill. Occasionally the fineness of grinding leaves much to be desired, pieces of hard bone up to ¼ in. in diameter being present. This coarsely-ground material must be less available, at any rate as regards the phosphates. It has been suggested that when large amounts of oil are present (seldom the case, however) the manure will be rendered slower in action.

The variation in the content of nitrogen and phosphates will be evident from the particulars given in the table * below, the analyses being those given by the manufacturers in each case. There is no doubt that the prices for manures have been high in the past; in the table is given a rough indication of the value based on the content of manurial ingredients. It is to be remembered, however, that all allowance must be made for "mixing," and that the value of a manure also depends upon such questions or special suitability for the soil, crop, and general conditions for which it is intended, and on such points as condition and convenience for general use, in addition to which organic manures improve the physical character of the soil.

ACTION.

The action of the nitrogen and the phosphates in fish manure is gradual and safe, these substances continuing to become available to the plant throughout the whole of the growing season. This is due in the case of the nitrogen to the fact that while, some of the compounds are soluble in water and rapidly decomposed by bacteria, the main constituents are proteins and galatinoids which resist attack to a greater or less degree. Fish manures are, however, more rapid in action than bone meals, on account of the greater quantity of nitrogenous organic matter which they contain; otherwise their action is very similar to that of meat guanos and bone meals.

APPLICATION.

Fish manure should be applied early in the year, when the land is first worked, and it should be worked into the land as soon as sown, otherwise rooks and other birds will eat it as long as they are allowed to do so. It is injurious to germinating seeds or the tender rootlets of growing plants until it has been in the soil for a short time and the first active fermentation is over.(—HALL).

Farmers should not have this manure delivered long in advance of the time when it will be used, since it has an unpleasant smell, becomes lumpy, and, though well-made samples do not contain much more than 20 per cent. of moisture, a high moisture content may result in heating and fermentation in storage and the loss of some of the nitrogen.—JOURNAL OF THE BOARD OF AGRICULTURE.

* Not reproduced.

ENTOMOLOGY.

BARK-EATING BORERS OF CACAO AND TEA.

The name "bark-eating borer" is descriptive of the habit of this kind of caterpillar. It eats the bark, and, when not feeding, takes shelter in a tunnel it has made in the stem or branch. It stays in retirement by day and feeds by night. The feeding ground is covered over with a canopy of frass bound together by silk, which gives the affected plant a dirty, neglected-looking appearance. The injury done is more indirect than direct, in that the wound may provide a point of entry to white-ants or fungi. One of these borers is exceedingly partial to cacao, and all neglected cacao, where it is able to multiply without restraint, is a menace to cultivated cacao. A caterpillar taken from a tunnel in cacao was about $1\frac{3}{4}$ inches long. When handled it exuded from the mouth a brown fluid. The head is dark-brown in colour and corrugated. The front, and sometimes also the clypeus and labrum are smooth and greenish-yellow in colour. Just dorsad of the clypeus are two short blunt tubercles, one on each side. Each thoracic and abdominal segment bears a large, smooth brown plate of chitin on the dorsum, that on the first thoracic segment being sometimes interrupted in the middle line, and several smaller plates on the sides. From these chitinous plates the body setae arise. The setae on the abdominal segments are arranged as in LEFROY's figure of the larva of *Arbela tetraonis*, Mo. (I. I. L. Plate XLV.) except that there are two, one of which is minute, in the group just ventrad of the spiracle and three at the base of the proleg on its outer side. There are four pairs of abdominal prolegs and a pair of anal prolegs. The hooks of the abdominal prolegs are arranged in a circle, interrupted mesally and laterally, of the anal prolegs in a transverse row. The venter is yellowish-white and abdominal segments one, two, seven, eight, etc., bear each a small plate of chitin.

Two pupæ taken at the same time from a similar tunnel in a neighbouring cacao tree belonged in all likelihood to the same species of insect. When free from the burrow the pupæ lie with the abdomen bent or roll over and over. One such is about 23 mm. long, another 17 mm. The head and thorax are dark brown, the abdomen yellowish-brown. The head and the anterior region of the thorax are almost black and are much corrugated. There is a short, sharp spine at the base of each antennal sheath, and in the larger specimen a distinct smooth round area, ventrad of the base of each of these. On the dorsum of the abdomen are ten transverse rows of spines, the two most anterior rows being shorter than the rest. Of the remaining rows the third, fifth, seventh and ninth are continued right round the body, while the fourth, sixth and eighth are slightly interrupted at two points, one on each side of the mid-ventral line, while the tenth is interrupted in the

middle line. (In the smaller pupa all the rows from the third backwards except the tenth, are practically continuous right round the body). Several spinous tubercles are grouped round the anal region.

These pupæ were collected in January and a moth emerged in February.

The insect is known as *Arbela quadrinotata*, Wlk. and belongs to the *Arbelidae*. It has the antennæ bipectinate and the legs hairy. The thorax is greyish, the abdomen silvery grey. Thorax and abdomen bear tufts of dark-brown hair, the terminal tuft being very conspicuous. The fore wings are greyish-brown with numerous, conspicuous, richly dark-brown spots and a band of similar colour runs from near the apex to the anal angle. The hind wings are bluish-grey with faint spots near the caudal margin and faint dark streaks near the inner margin. Wing expanse about 40 mm.

A structurally and biologically similar but smaller caterpillar has been recently reported from Kurunegala as seriously damaging the tender leading shoots of *Berrya ammonilla*, Roxb. (Halmilla, Trincomalee wood.)

I have seen a similar caterpillar in stems of *Cananga odorata*, *Ixora coccinea* and *Hevea*. What was probably the same species of caterpillar had been previously recorded from Nuwara Eliya (in cacao), Ruanwella (in Albizzia and Hevea), Matale (in Albizzia). In India, according to ANTRAM the caterpillar of this insect attacks tea, mango, Ficus, *Albizzia stipulata* and "almost every jungle tree of rapid growth." So far as I know it has not been reported from tea in Ceylon. GREEN remarks regarding a caterpillar from tea at Bandarawella—"larva appears to be an *Arbela*," adding, however, subsequently, "possibly the larva may be a young *Phassus*."

WATT and MANN refer to a bark-eating borer as doing damage to tea in Assam, Sylhet and Cashar. LEFROY mentions *Arbela tetraonis*, Mo. as boring into lichi, bair, guava, mango, orange and other fruit trees in India, while FLETCHER gives "Casuarina, rain-tree etc." as its host plants and characterises it as a "sporadic serious pest."

Our bark-eating borer of tea is distinct from the above insect. It is larger. I have seen one about $2\frac{1}{8}$ inches long. The gallery is about $\frac{3}{8}$ inch in diameter and may run down the centre of the stem for $1\frac{3}{4}$ inches or more; its walls are often crimson in colour. The tunnel usually opens near the base of a branch above or below. I have seen a plant in which the bark had been eaten from a broad transverse band at the level of the mouth of the gallery. Unlike the gallery of *Zeuzera coffeae*, Red Borer, our common borer of tea, the gallery of this caterpillar, so far as I have been able to observe, does not widen out at intervals. The caterpillar when handled exudes a brownish-red fluid from its mouth. The head of the caterpillar is dark brown, shining and corrugated especially caudad of the ocelli. The prothorax is of a lighter brown colour, chitinised and shining. Cephalodorsad of the prothoracic spiracle is a black oval area, The abdomen is somewhat soft and of a dirty whitish colour. Each abdominal segment bears an elliptical, transverse, raised, slightly chitinous area bearing two setae. Some show a white area in the centre of the dorsal plates of some of the abdominal segments. Caudad of each dorsal plate are two smaller plates each of which bears a seta. Dorsad of the spiracles, which are oval and black, is a small plate of chitin bearing two setae situated close together,

the more anterior of the two being much the smaller. Caudad of the spiracle is a chitinous plate bearing two setae and ventrad a small plate with one seta. On the base of the proleg are five setae arranged thus—three laterad, one cephalad and one mesad. There are present four pairs of abdominal prolegs and a pair of anal prolegs. The hooks on the abdominal prolegs are arranged in a complete circle and are of two lengths, the shorter ones being situated at the base and on the outside of the larger ones. The circle of hooks on the anal prolegs is open caudally. There is a dark-brown oval spot in the middle of the circle on the abdominal prolegs and two small black spots within the ring on the anal prolegs. A pupa which is probably that of the same species of insect is about 1 7-10 inches long. It was taken from a similar tunnel in a tea bush. Unfortunately in the process it has been injured, unfortunately, because so far as I know, the adult insect is not known as such. The pupa has the head and prothorax dark-brown in colour and corrugated. The rest of the body is yellowish-brown in colour. There is no prominent spine at the base of the antennal sheath as in *Arbela quadrinotata*. There is no 'snout' as in *Zeuzera coffeae*. It bears several transverse rows of backwardly-directed, small spines situated on prominent ridges ; of these there are some ten on the dorsum and five on the venter. They are obsolete on the more posterior segments. The spiny ridge near the cephalic margin of each segment is much stouter than that near the caudal margin. The dorsal anterior ridges do not run straight across but are re-entrant in the middle, the dorsal ones somewhat widely re-entrant and curving towards the anterior end, the ventral ones more narrowly re-entrant the curve in this case pointing towards the posterior end.

There are no spinous tubercles at the anal end as in *Arbela quadrinotata*. I have seen a smaller but structurally similar caterpillar boring in a branch of *Clerodendron infortunatum*. We have records of the caterpillar from Dimbula and Pinnawella and what is probably the same species had been previously recorded by GREEN in tea from Bandarawella, Neboda, Ohiya ("ex root of plant; it appears to be a Cossid or a Phassid," GREEN), Hanjuranheta and Gampola. As stated above the larva and adult of this insect have not, so far as I am aware, been correlated. The structure of the caterpillar and especially the arrangement of the body setae suggest that the insect belongs to the *Hepialidae*, the most generalised of moths, and whose caterpillars are known to live on the roots or in the stems of plants

An insect belonging to this group and known as *Phassus malabaricus*, Mo. has been bred from a tea root in India. Regarding this insect LEFROY writes :—"The larva bored down the root of the tea bush from soil level, the pupa lying in the bore towards the opening. The moth hangs by day by its forelegs with the wings wrapped round it in the position a flying-fox or bat has." At least one insect of this genus occurs in Ceylon, viz., *Phassus purpurasceus*, MOORE, which GREEN has reared from a larva boring in the stem of *Cinchona succirubra*, Pav.

Various methods of dealing with these pests have been employed with more or less success. The caterpillars may in some cases be reached with a wire probe and killed. A quantity of carbon bisulphide may be poured or squirted into the tunnel and the entrance thereafter closed. In the case of

the Halmilla trees referred to above it was suggested that, failing the obtaining of carbon bisulphide, a small quantity of kerosene should be squirted into the tunnel so as to drive the caterpillar out, experimenting with a few trees at first to see whether the kerosene would have an injurious effect on the plant. This method was reported by the Assistant Conservator of Forests to be very successful. Plugging the entrance with tar so as to envolve the escaping caterpillar has also been known to give satisfactory results. Where practicable the caterpillars could be killed at night while out feeding; this method could hardly be adopted in the case of tea, unless the affected plants had been marked during the daylight.

A. RUTHERFORD.

DISC HARROWS.

F. G. SPRING.

Some notes on the efficiency of disc harrows have recently been received from a planter in Malaya, and may be of interest to those who adopt this method of cultivation.

"After a good deal of experience with the disc harrow I was not at all satisfied with its efficiency until I tried the experiment of removing each alternate disc; converting the ordinary 12-disc harrows into wide-spaced 6-disc harrows. The result was most satisfactory, and a very good tilth can be obtained, with the advantage of a well-marked furrow. In the final harrowing of a field, the furrows are left transversely to the slope of the ground, and surface wash is reduced to a minimum. The top soil in which the harrows are cultivating it is a sandy clay and in places a sandy loam. It is all old tapioca land reclaimed from lalang. The soil cakes very hard on top fairly rapidly if left uncultivated."

The above result would possibly not be obtained to the same degree on light and heavy types of soils. The formation of a well marked furrow is important as more prominent ridges are capable of withstanding, to a larger extent, the beating down effects of rain, and thus reduce, if the furrows are transversely to the slopes of the ground, the damage done by surface wash. Small ridges on light soils, could not withstand, for any length of time, heavy rains.

It is obvious that the remarks refer to undulating land, and for such, the method seems a good one. It should not be taken, however, that the same would necessarily apply to flat ground. The nature of the sub-soil would also require to be taken into account.—AGRICULTURAL BULLETIN.

CO-OPERATION.

CO-OPERATIVE CREDIT SOCIETIES IN MYSORE

The annual report of the Registrar of Co-operative Credit Societies on the working of Co-operative Credit Societies in Mysore for the year 1912-13 which is to hand, is of special interest to Ceylon as it contains valuable information applicable to local conditions.

The year's work has been very satisfactory and there is marked progress over that of the previous towards this result the public and the Mysore Government have equally contributed.

In his summary of progress the Registrar states that a desire for increased knowledge through Conferences and Co-operative publications, a more intimate relation of Societies than that of the past year, a great degree of public confidence in the usefulness and the stability of the Co-operative movement, the sympathy and interest of the leaders of the people in the movement, the active propaganda carried on by the department, and the good work done by each Society in its area of operation have been the features which contributed to the success of the movement during the period under review.

The second Provincial Conference for the whole of the Mysore State was held in 1912 and was attended by about 350 delegates and over 200 others. The conference was opened by His Highness the Yuwaraja of Mysore (SIR SRI KANTHIRAVA NARASINNARAJA WADIYAR BAHADUR, K.C.I.E.). One of the resolutions passed at this conference provides for the holding of district conferences.

Among the objects of the Societies is the fostering of weaving, lac and other industries besides agriculture. A Society has been formed among the coolies employed at the Kolar gold fields, another for the Body Guard of HIS HIGHNESS THE MAHARAJA, and yet another for the employées of the Palace Stables at Mysore. Such non-agricultural societies have proved very useful in rescuing members from the clutches of userers and promoting thrift among them.

The number of Societies in Mysore State has increased from 208 in 1911-12 to 343 in 1912-13, i.e., an increase of 135 Societies or 65 per cent. The number of members in 1911-12 was 13,148 and in 1912-13 it rose to 25,538, or an increase of 11,390 or 85 per cent. The total working capital in 1912-13 was Rs. 1,289,338 against Rs. 675,312 in the past year. It is satisfactory to find that the growth of the capital by nearly 99 per cent. over the past year is due to the private resources of the Societies. Deposits have formed a substantial part of the working capital, the increase of deposits being 59 per cent. over those of the past year. The total thus received within the year was Rs. 628,830 against Rs. 395,214 of the year before. The increase of deposits is one of the principal tests of the success of the movement.

The total profit made during the year under review was Rs. 129,981, of which amount the net profit was Rs. 62,520 against Rs. 18,833 last year. A sum of Rs, 11,767 has been added to the Reserve Fund bringing it to a total of Rs. 30,600.

The total number of loans issued to members was 41,957 of the value of Rs. 1,949,289. The largest number of loans was given on the security of the good character of the borrower. The number of loans given on the joint liability of borrower and one or more sureties is the next largest in number and the rest on the security of property movable or immovable.

Efforts are being made to encourage the grant of loans on the security of the good character of the borrower instead of taking security of property.

N. W.

CO-OPERATIVE CREDIT SOCIETIES WITH LIMITED LIABILITY.

Hitherto the Agricultural Co-operative Credit movement, which has conferred such great benefits upon the agricultural population of many other countries, has made very little progress in England and Wales. At the end of the year, 1912, there were in this country only 46 agricultural credit societies, with 863 members, and during the year the total number of loans granted by them to their members was 182, amounting in all to £1,895. Such progress as has been made is due mainly to the exertions of the Agricultural Organisation Society and its predecessors, who drew up a set of model rules on the Raiffeisen principle of the unlimited liability of each and all of the members for the debts of the Society : and all the existing agricultural credit societies are based upon this principle. They are registered under the Friendly Societies' Act, and confine their operations to the granting of loans to small agriculturists for such purposes as the Committee of the Society think likely to be profitable to the member borrowing the money. Such a Society has no share capital, and the rules lay down that no part of its funds shall be divided by the way of profit, bonus, dividend, or otherwise among the members, the main object of the society being to enable its members to obtain small loans for profitable agricultural purposes at as low a rate of interest as possible. So far as they go, these small societies have been very beneficial to their members, and have, on the whole, been well and economically managed, the expenses of management amounting on the average to a little over £1 per society per annum.

The loans are taken generally for such purposes as the purchase of sheep, pigs, cattle, horses, carts, implements, feeding-stuffs or manure, or the employment of extra labour on the borrower's holding, and are, as a rule, made repayable about the time when the borrower may expect to reap the return of his expenditure, so that the date fixed for repayment is usually from six to twelve months after the date of the loan. By means of these societies a number of small farmers and labourers have obtained the small loans needed for their agricultural operations at a lower rate of interest than they would have had to pay elsewhere, and some of them have been able to secure loans who could not otherwise have borrowed at all. Instances may be cited of

men who were enabled by loans from their societies to buy and feed sheep, pigs, or cattle, to hold over stock or produce for better prices, to procure seed, plants or manure, to work their land to better advantage, or to add to the area of their holdings : and of some, who by means of a succession of such loans, have risen from the position of labourers to that of substantial smallholders.

The slow progress of the movement in this country may be ascribed to several causes. It is no doubt partly due to the comparatively small number we have here of homogeneous communities of small farmers ; partly to the fact that England and Wales are exceptionally well supplied with banks which are willing to make advances to individual borrowers at a fair rate of interest, provided that the security for the loan is satisfactory ; partly to the reluctance of the English smallholder to combine with his neighbours and apply to them for pecuniary assistance, even in the form of a loan repayable with interest, and to make to them the disclosure of his private affairs which a lender may reasonably require before making an advance. Some societies have also found a difficulty in obtaining the funds necessary for their operations on the basis of their joint security, owing to the unfamiliarity of possible lenders with the co-operative principle as applied to credit.

In order to reduce this difficulty the Board of Agriculture and Fisheries approached a number of the leading joint stock banks, and after considerable discussion, were successful in enlisting their sympathy and obtaining the consent of twenty-two banks to an announcement that they were ready to assist registered Co-operative Credit Societies, consisting mainly of smallholders and allotment-holders, to the following extent : They were prepared to allow the manager of a country branch to assist in the formation of such a society, to give advice to its members on matters of book-keeping, to take part when requested in the audit of the annual return without remuneration, and in special cases to accept the post of unpaid treasurer. The banks agreed to give favourable consideration to applications from such societies for advances, of course requiring in each case to be satisfied as to the security for the loan ; and in general practice to allow the loan to stand for twelve months, subject to reconsideration at the end of that period. They also agreed that when a bank is satisfied that the joint liability of the members of a society under its rules constitutes an adequate security for a loan, the bank would require no further guarantee for its repayment ; and that the rate of interest to be charged on approved advances would be a favourable fixed rate, subject to a year's notice of alteration.

These valuable concessions by the banks have been made in favour of co-operative credit societies formed under the model rules issued by the Agricultural Organisation Society, which make all the members of a society liable without limit for the debts of the society. They have already been taken advantage of by a few societies, and there is reason to expect that, should a community of small holders found a society on this basis, and appoint a trustworthy committee, they will have no great difficulty in obtaining a small advance from one of these banks at a fair rate of interest ; and should their business be conducted on sound lines, and more especially, should they be able to show the bank that the loans they make to their members are used

for profitable agricultural purposes and punctually repaid, they may hope to obtain from the bank a gradually increasing advance to enable them to extend their operations.

Perhaps the principal reason, however, why so small a number of co-operative credit societies have been formed in this country is that there is here a strong objection among all classes to incur an unlimited liability, an objection which cannot be got over by pointing to the fact that, according to the experience of thousands of successful societies of the kind in other countries, it is perfectly safe for a community of smallholders, covering an area sufficiently limited to enable them to judge of each other's character and trustworthiness, to work a society of this sort on the basis of unlimited liability. In order to meet this objection, it seemed desirable to draw up a set of model rules for a credit society, based upon the more familiar principle of liability limited by shares. This system is in accord with the opinion expressed by MR. H. W. WOLFF, a leading authority on agricultural credit, in the preface to his Co-operative Credit Bank Handbook, where he says "A quite unwarrantable impression appears to have got abroad to the effect that co-operative banks with shares and limited liability are applicable to towns, and that for rural purposes, and the service of agriculture, only the peculiar system can come into account which dispenses with shares and makes liability unlimited. There could not be a greater mistake, and were the impression to become general, serious prejudice would be done to agriculture." He goes on to say that in this country, of all others, banks with shares and limited liability appear indispensable, if banking work for the benefit of agriculture is to be done on a large scale.

The Friendly Societies Act, under which the existing modern rules framed by the agricultural Organisation Society have been drawn up, is not applicable to a form of society based upon liability limited by shares. The new model rules have, therefore, been, framed under the Industrial and Provident Societies Act, which regulates the numerous highly-successful co-operative distributive societies with which this country is covered.

It is unusual to find in a rural parish a community of smallholders sufficiently numerous to form of themselves a credit society having the restricted area which is necessary for its proper working. It seems advisable, therefore, while retaining the important principle of neighbourhood, and consequent knowledge by the members of each other's character, to extend the operations of a society to all classes residing within an ordinary country parish, by leaving all free to take part in the working of the society, whether they are directly engaged in agricultural work or not. At the same time, it is important to keep in mind that the object of the society is not to enable shareholders to obtain a large dividend on their shares, but is to provide small loans to small men of good character at as low a rate of interest as can be worked down to without incurring loss to the society. For a similar reason, it seems advisable not to confine loans to purposes which can strictly be called agricultural, but to make it possible for a society to advance money to a member for any profitable purpose connected with the life of a rural parish, although it may be only indirectly connected with agriculture.—JOURNAL OF THE BOARD OF AGRICULTURE.

GENERAL.

CEYLON AGRICULTURAL SOCIETY.

Meeting of 24th November, 1914.

Minutes of proceedings of a meeting of the Board of Agriculture held at the Council Chamber on Tuesday 24th November, 1914.

The Honourable the Colonial Secretary (in the absence of His Excellency the President) presided.

The following were also present.—The Hon. Mr. Bernard Senior, Hon. Mr. Harry Creasy, Hon. Mr. A. Kanagasabai, Hon. Mr. L. W. A. de Soysa, Hon. Sir S. C. Obeyesekere, Sir Ponnambalam Arunachalam, Hon. Mr. A. S. Pagden, The Director of Education, The Director of Agriculture, The Government Agricultural Chemist, The Government Mycologist, Asst. Government Mycologist, Manager Experiment Station Peradeniya, Manager Dry Zone Experiment Station, The Curator, R. B. G. Peradeniya. Dunuwille Dissava, Messrs. G. A. Joseph, James Peiris, Francis L. Daniel, H. L. De Mel, W. Amerasuriya, A. W. Beven, K. Bandara-Beddewela, W. S. Stephens, A. W. Winter, J. Clovis de Silva, Professor Armstrong, Dr. H. M. Fernando, Mudaliyars Tudor Rajapakse, A. E. Rajapakse, R. Chelvadurai-Proctor, S. Weerackkody and the Secretary (Mr. C. Drieberg).

Minutes of the meeting held on February 3rd, 1914, were read and confirmed.

The Progress Report previously distributed was taken as read and adopted.

Statement of Expenditure to end of October was tabled.

The Director of Agriculture submitted the Report of the London General Committee on the proposed Imperial College of Tropical Agriculture, indicating the position at date.

Sir Christoffel Obeyesekere moved the following resolution:—"That the thanks of this Board be conveyed to Sir Henry McCallum and the other members of the London Committee for their efforts in urging the claims of Ceylon as the site for the Imperial College of Tropical Agriculture, and that its appreciation of the success which those efforts have met and of the energy and enterprise exhibited by Mr. R. N. Lyne in promoting the project, be recorded."

Sir P. Arunachalam in seconding the motion suggested that pending the adoption of the larger scheme a beginning should be made with a school of Agriculture to meet local requirements. The Director of Agriculture explained that this possibility had been considered. Four students were being trained at the Poona College of Agriculture for instructing teachers of vernacular schools in the elementary principles of agriculture. These students would be competent to teach in English also and thus a school of agriculture could be established that would pave the way for a College.

A meeting of the SOCIETY followed at which the Director of Agriculture presided.

Mr. A. W. Beven read a paper on the "Extension of Paddy Cultivation" In the animated discussion that ensued the following members took part:—Mudaliyar Weerackkody, Mr. James Peiris, Sir P. Arunachalam, Sir C. Obeysekere, Dr. H. M. Fernando, The Hon. Mr. Kanagasabi, Mr. A. W. Winter and the Chairman.

A paper entitled "The Improvement of Agricultural Cattle" by Mr. N. Wickremaratna was taken as read.

Both writers were accorded a hearty vote of thanks.

C. DRIEBERG,
Secretary, C. A. S.

Peradeniya, 24th November, 1914.

FORMATION OF A TECHNICAL INFORMATION BUREAU AT THE IMPERIAL INSTITUTE.

For some years past a steadily increasing stream of enquiries has been received by the Imperial Institute from manufacturers, merchants and others in Great Britain and the Colonies. These enquiries relate principally to new sources of supply of raw materials, methods of utilising new products from the Colonies and India, or to new or little known processes and machinery for industrial purposes. The number of these enquiries has now become so great that the Secretary of State for the Colonies has authorised the formation of a Technical Information Bureau at the Institute for dealing with them.

This Bureau will be a special branch of the Scientific and Technical Research Department, and will be staffed by experts who have had the advantage of experience in the work of that Department of the Imperial Institute, which is carried on in communication with producers in the Colonies and with manufacturers and users of raw materials in this country.

The present is a specially opportune moment for the formation of such a Bureau, since the paralysis of German and Austrian trade and industry opens up opportunities for the development of many industries in this country and in the Colonies which have hitherto been monopolised by Germany. The new Bureau is already playing an active part in this work, and some examples of its activities may be given, to illustrate the kind of assistance it is prepared to render.

SUPPLY OF POTASH.

A very important question at the present moment is that of the supply of potash salts, which are essential in certain branches of glass and soap manufacture and for the preparation of a large number of chemicals and manures. Germany has for many years had a practical monopoly of this industry, owing to her possession of the great potash mines of Stassfurt. The only country which has made any attempt to break this monopoly is the United States. The possible sources of supply of potash to England just now are small, being limited to imports of nitre from India, potash made from Irish and Scotch kelp, and a little obtained as by-products from wool and waste timber. Numerous enquiries have been received at the Imperial Institute from British manufacturers on this subject, and they have been placed in communication with firms who may be able to meet their requirements. It is quite certain, however, that the existing supplies are quite inadequate to meet all the demands, and the Bureau is preparing a statement as to sources of potash, which will include some hitherto almost untouched for industrial purposes. The necessary enquiries will occupy some time, but it is hoped to issue the statement by the end of the present year.

NEW MARKETS.

An equally important matter is that of finding markets in this country for the immense quantities of raw materials from India and the Colonies formerly exported to Germany. As examples of these, palm kernels and copra may be mentioned. These products have been exported on a very large scale to Germany to be worked up into oil and feeding-cake, the former being then largely exported to England. There is no reason why this industry should not be transferred to such great oil-seed crushing centres as Hull and Liverpool. A statement giving full information regarding the German palm kernel industry is published in the "Bulletin of the Imperial Institute" (No. 3 of 1914), and the Bureau is prepared to place manufacturers interested in this industry in communication with merchants dealing in palm kernels, and similar action is being taken regarding copra and other raw materials.

AJOWAN.

One of the minor results of the European War is a great scarcity of thymol, a substance extensively used in medicine and pharmacy as an antiseptic. The reason for this scarcity is found in the fact that practically all the ajowan seeds from which thymol is extracted are exported from India to Germany. The preparation of thymol from these seeds is a simple chemical process which can be carried on quite easily in this country. The necessary information for action on this subject has been supplied by the Bureau to various firms of British manufacturers.

Written enquiries should be addressed to the Director, Imperial Institute, S. W., and marked "Technical Information Bureau."

The Bureau is of course only one branch of the Institute. The Scientific and Technical Research Department of the Institute will continue as before to investigate the commercial possibilities of raw materials from the Colonies and India in its own laboratories and workshops.

The Public Exhibition Galleries of the Institute, which include a complete and permanent exhibition of the raw materials and primary manufactures of the overseas Empire, are continually being added to, and are open daily to the public free.

SORGHUM SMUT.

Specimens of imphee attacked by a smut disease were recently received from Montserrat, with an inquiry as to treatment. The smut proved to be due to the well-known *Sphacelotheca* (Uslatago) *sorghi*, (Lk.) Clinton, which is known to occur from time to time on imphee and Guinea corn in the West Indies.

The spores of the fungus are usually sown with the seed, germinate in the soil at the same time, and infect the seedlings at an early stage. The mycelium of the fungus keeps pace with the extension of the plant in the form of thin threads which grow up through the softer tissues, especially the pith. No particular damage to the plant is caused and no sign of the disease is visible until the period of flowering, when the fungus develops rapidly in the anthers and ovaries, and there produces masses of black powdery spores which replace the pollen and the seeds. The outward appearance of the panicles is not much altered until the membrane which at first encloses the spore masses bursts, when they appear as if coated with powdery soot.

The spores are very resistant, and the occurrence of a small quantity of smutted material amongst the seed corn is capable of producing widespread infection in the following crop. The disease is thus cumulative, and its occurrence even in small proportions should therefore not be considered negligible.

Treatment is rendered easy by the absence of the fungus from the interior of the seed, and owing to the fact that only very young plants can be infected. Any method which secures the sterilisation of the seed without destroying its germinative power is effective.

Two types of treatment are in common use against this and other diseases of a similar nature, depending on the use of (1) chemical fungicides, (2) hot water, for the killing of the spores. The hot water process is a somewhat delicate one, since a temperature of at least 129° F. has to be maintained in order to secure the desired effect, and a temperature above 138° F. is liable to kill the seed. This involves an equipment and a carefulness in handling that are not always at the service of the West Indian planter. The use of chemical fungicides is more likely to meet his case.

The substances most in favour for the purpose are (1) formalin and (2) copper sulphate. Dilute solutions of either substance may be used in two ways. The seed is either steeped in the solution or is sprinkled with it and then thoroughly mixed in order to secure uniformity of action. Commercial formalin is a 40-per cent. solution of formaldehyde gas in water. It is not dangerous to use, but its fumes have a strongly irritant action on the mucous membranes of eyes, nose, and throat, and even weak solutions cause a harshness and peeling of the skin if allowed to remain in contact with it for any considerable time. A solution of proper strength is obtained by mixing 1 pint of formalin with 30 gallons of water. The cost of formalin in Barbadoes is 3*s*. per (Imperial) pint. If copper sulphate (bluestone) is used, 1 lb. should be dissolved in 10 gallons of water.

In carrying out the steeping method, the seed is contained in a bag or close basket and immersed in the solution, being lifted up and down a few times to get rid of the enclosed air. The time of soaking is two hours in the case of formalin, three minutes in the case of copper sulphate solution.

In the sprinkling method, if formalin is used, the grain, after it has become thoroughly wet, should be left in a covered wooden vessel, or in a heap covered with wet sacking, for several hours, and then spread out to dry If copper sulphate solution is used, the grain should be dried immediately.

It is advisable to test the germination of the treated seed before sowing, so that allowance may be made for any which has been killed. Formalin is less likely to damage the seed than copper sulphate solution.

In handling the grain after treatment, the greatest care should be taken that it does not come into contact with any article that is likely to be contaminated with smut spores, and that it is not exposed where dust which may contain the spores is likely to settle upon it.

There is another sorghum smut, *Sphacelotheca* (Ustilago) *reiliana*, (Kühn) Cl., which differs from the above in that, instead of the grains being affected separately, the whole head is conglomerated into a smutted mass.

This does not appear to have been recorded from the Lesser Antilles. It is not amenable to the treatment described above, but must be met by obtaining seed from an uninfected source.—AGRICULTURAL NEWS.

VEGETABLE OILS AT THE RUBBER EXHIBITION.

Wandering round the French Court we found a group of friends "matching" three oil seeds, somewhat resembling a pale-coloured horse-chestnut, that they had been hoarding up for some time, and which by unanimous consent were voted to be *Butyrospermum parkii, alias* karite-nuts or shea-nuts, a nut with which much can be done if supplies are large and regular. The French section generally was certainly an easy first as regards a complete exhibit of vegetable oils and the various tropical products from which they are derived. Husked and unhusked coconuts were met with on all sides, also European-dried copra from Cochin China. M HENRI WOOG, the broker, of Paris, had an attractive stall with a very representative collection of vegetable oils generally, intermingled with cereals, rubber and rice.

The Malayan court and the Kelantan stall both had coconuts and copra on view, the Ceylon court also ; but a particularly interesting section in the last named was the desiccated coconut exhibit, made up of the well-known fine and coarse-grain kinds, also some new forms as shreds and flakes, etc., sent over on purpose to test the market and to see what the public here thought of them. For fancy cakes, confectionery purposes, curries, etc., we should imagine that these new forms will meet with general approval and a consequent big demand. The Malay exhibits included the following for comparison : The nior ratus, or hundred coconut ; nior jambu, or rose-apple coconut ; nior blimbing, or blimbing coconut ; nior kuning, or yellow coconut; nior rasumba, or rose-red coconut ; nior gading, or ivory coconut ; nior hijan, or green coconut ; nior sekol ; nior kapal, or ship coconut ; nior gelok, or water-bottle coconut. Of "Fancy" coconuts in the Ceylon Court, though we did not notice samples, we were told that they include the "king coconut," which bears a yellow fruit, distinguished by its sweet juice and esteemed for culinary purposes, though the meat is of little value as copra. Then there is the "dwarf coconut," which bears fruit when only 2 feet or 3 feet high, and the nuts small in proportion. Their "needle coconut" coming from the Nicobar Islands, bears a large triangular fruit, the nut having a sharp point at one end. The "Maldive coconut" has a small, almost spherical fruit, and the "edible husk coconut" is furnished with a husk which, when young and tender, is fleshy and of a sweetish acid taste.

British Guiana is also making a bid for coconuts, which thrive well along the coasted lands of the colony, especially where the land is more or less sandy, and although the 5,000 acres under this crop in 1904 has already increased to 14,000 acres, a considerable expansion of their cultivation is still possible and expected.

Queensland was also there, and so were the New Hebrides, the Dutch West Indies, Fiji and, of course, MR. O. W. BARRET and the Philippines, about which we say nothing, for once we begin discussing the *Cocos nucifera* in those islands there is no saying where we shall finish. Coming now to another centre and a latter-day competitor for the present demand for edible vegetable oils, we encounter British Honduras, and its cohune nut *(Attalea cohune)* cousin of the Brazilian uricuri *(Attalea excelsa)*, both of which could and do yield an oil that may yet make itself felt in the oil-buying and consuming world. Guatemala to the south also claims to have large cohune nut areas, only they call them corozo-nuts. The palms yield from one to four bunches a year, each bunch weighing something around 1 cwt., each, of which the kernel accounts for 8 to about 14 per cent. only, with a percentage of 65 to 71 per cent. of oil. From accounts to hand the cohune palm flourishes in British Honduras along what is known as the cohune ridges. Many trees have been cut out when clearing the land for planting, but the "yarns" some company promoters want us to swallow about the wild palms being found as crowded as eighty to the acre, are surely a little too overdone.

—TROPICAL LIFE.

PALMNUT KERNEL CAKE.

J. ALAN MURRAY.

It was feared by many, farmers and others, that the outbreak of war would cause a considerable rise in the prices of certain feeding cakes and meals which are imported from abroad. It appears, however, that the natural tendency of prices to rise from this cause has been more than counter-balanced, in some cases at least, by the loss of the German market. Notably, this has been the case in regard to palmnut kernel cake, and as most of the raw material—the palmnut kernels—comes from British Colonies in Africa the subject is deserving of the attention of traders and farmers alike.

Of the enormous quantities of palmnut kernels shipped annually from West Africa by far the greater part has hitherto gone to Germany. Indeed, the producing Colonies have been practically dependent on that country for the purchase of one of their staple commodities. For example, last year Germany imported 232,125 tons of palmnut kernels, and of that quantity 202,839 tons, i.e., over 87 per cent. of the whole, came from British Colonies in Africa.

That all these kernels were not required by Germany for the production of oil for home consumption is shown by the fact that in the same year she exported 28,489 tons of oil, which is equivalent to about 64,000 tons of kernels.

The position in regard to palmnut kernel cake is very different. Germany not only consumes all the cake she manufactures but also imports thousands of tons annually from this and other countries. So far as Germany is concerned, the cake has become the principal and the oil the bye-product. The result was that the price of palmnut kernel cake had risen to such an extent in this country that our farmers found it unprofitable to buy, and before the outbreak of war it had become almost unobtainable.

This state of affairs, however, is now completely altered. The German market for the cake is cut off, the price has fallen, and there is thus an opportunity for farmers at home to obtain this cake in some quantity. The crushers, however, complain that farmers show little inclination to profit by the position. In the past, palmnut kernel cakes achieved a rather unenviable reputation ; and farmers are unfamiliar with the properties and composition of the more modern product, and do not know exactly how to use it to advantage.

The palm fruit, from the palm *Elaeis guineensis*, is about the size of a chestnut. The actual nut or stone is, however, much thicker in the shell and is very hard. It is covered with an outer coat or pericarp consisting of fibrous, oily material, and it is from this pericarp that the palm oil, properly so called, is expressed. To obtain this oil, the natives of the country of origin pound the fruit in wooden mortars, generally after a process of fermentation ; the pulp is then boiled in small kettles and the oil is squeezed out by hand. This crude method is not only wasteful, but the oil produced is of low quality and is usually rancid. After the palm oil has been thus removed the nuts or stones are cracked, as one would crack a walnut, and the kernels are separated. It is from these kernels that the palmnut kernel cake is prepared by crushing out the oil.

At one time palm oil was made by crushing the fruit as a whole, but the results were considered unsatisfactory, and the method is not now employed to any extent. The oil left in the cake produced in this way rapidly turned rancid and the cake was refused by cattle. It is probably owing in large measure to this fact that palmnut kernel cake is still regarded by many farmers as a somewhat unsavoury food.

At the present day the kernels are imported into this country in a perfectly fresh condition, and before they are crushed they are subjected to a process of cooking, by which the ferment that causes the oil to turn rancid is rendered inactive. If palmnut kernel cake is stored in a suitable, dry place there is little danger of fermentation taking place.

In the modern processes the crushing is heavy, and the amount of oil left in the cakes is much smaller than formerly. This may at first sight be regarded as a serious defect in a feeding cake, but—price apart—it is not so. On the contrary, the low percentage of oil appears to reduce the laxative effects which are said to have been observed, but which may have been due to rancidity. Further, as a necessary consequence of the reduction in the percentage of oil, the percentages of all other ingredients are correspondingly increased. The modern palmnut kernel cakes differ from those formerly produced in another respect, which, in the writer's opinion, is of much greater importance—they contain only about one-half the amount of woody fibre that was commonly present in the cakes produced by the older methods.

These facts are strikingly illustrated by an analysis recently submitted by one of the largest producers in England, and which is compared with some earlier analyses in tabular statement below :—

ANALYSES OF PALMNUT KERNEL CAKES.

	Crowther (1908)	Kellner (1905)	Smetham (1909)	Recent (1914)
Albuminoids ...	17·0	17·7	15·89	18·5
Oil ...	10·0	8·6	9·14	5·5
Carbohydrates ...	36·0	36·2	41·66	50·0
Crude fibre ...	22·0	23·8	19·74	10·0
Moisture ...	10·0	9·7	9·73	12·2
Ash ...	5·0	4·0	3·84	4·0
	100·0	100·0	100·00	100·0

The writer is unable to guarantee the accuracy of the recent analysis, and he would be the last to suggest that a purchaser should accept the word of the seller in regard to the composition of this or any other cake. The seller is bound, by Regulations under the Fertilisers and Feeding Stuffs Act, to guarantee, within reasonable limits, the percentages of oil and albuminoids. He is not bound to give any guarantee respecting the percentage of woody fibre, but he is at liberty to do so, and farmers would be well advised to ask for such a guarantee. It is not more unreasonable to do so than to ask the manure merchant for a guarantee as to the amount of oil in fish manures; for, just as the oil depreciates the value of the fertilising ingredients of the manure, so the presence of a large proportion of crude fibre depreciates the nutritive value of the ingredients of the cake.

In KELLNER's analysis the crude fibre amounts to over one-fourth of the dry matter of the cake, and one would naturally expect that this would tend to depress the digestibility of the nutrients and so diminish their value. KELLNER, indeed, suggests that such is not the case, but this suggestion amounts to a refutation of his main thesis and should be accepted with reserve. Since manufacturers now profess to be able to produce palmnut kernel cakes containing not more than 10 per cent. of fibre, they should be asked to give a guarantee of that or some similar maximum amount (say 12 per cent.).

Manufacturers who are now trying to push the sale of palmnut kernel cake in this country should realise that they still have to reassure farmers regarding its keeping qualities. Probably the readiest means to this end

would be to undertake to refund the price paid for any portion of a consignment that goes bad within a given time—say, three months. It may possibly be found that such an undertaking is actually implied by the guarantee that the substance is suitable for use as cattle food, provided it is kept in a place suitable for storing oil cakes. Co-operative buyers who are in a strong financial position might consider this point.

Is there, then, any reason—apart from such considerations as the benefit to the Colonies and promotion of British industries—why farmers should not give a trial to palmnut kernel cake? So far as the writer is aware, the cake possesses no special or peculiar properties. The question is purely one of economics. At the present time these cakes are quoted at £5 1*s.* 3*d.* per ton f.o.r. at Liverpool. The analysis submitted along with this quotation (and given above) shows that the price is about 11*d.* per unit. The price of decorticated cotton cake corresponds to about 1*s.* per unit. To whatever extent the former can be substituted for the latter there would, therefore, be a saving of about 1*d.* per unit; but it should be kept in view that this means a difference of 9*s.* per ton in favour of palmnut kernel cakes, i.e., 9*s.* less for the same amount of nutritive matter. The price quoted in London during September and October has been £6 5*s.* to £6 10*s.* per ton.

It has been shown above that palmnut kernel cakes vary considerably in composition, especially as regards oil and crude fibre. It is more than usually important, therefore, for farmers to have these cakes analysed and to procure advice from the agricultural colleges in their provinces or other similar source, as to price. As matters now stand the writer considers that, subject to an undertaking as to keeping, and a guarantee of not more than 12 per cent. of crude fibre, a farmer who buys palmnut kernel cake at 11*d.* per unit makes a good bargain.

Palmnut kernel cakes may be used for various purposes but they are employed most extensively for feeding milk cows. There appears to be no certain information regarding the effect of these cakes on the quality of butter, but it seems probable that, if anything, they would tend to harden it. The experience of foreign stock-feeders, however, would appear to indicate that palmnut kernel cake would make a very good substitute for linseed cake in feeding dairy cattle. Cows may receive up to 5 lb. per head per day.

Palmnut kernel oil, which is largely used for human food, is very suitable for certain classes of stock, though there is not sufficient information available to enable a definite comparison to be made between palmnut kernel and linseed oils.—JOURNAL OF THE BOARD OF AGRICULTURE.

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A BRITISH INSTITUTE OF TROPICAL AGRICULTURE.

Just upon four years ago PROFESSOR DUNSTAN advaned his epoch-making suggestion at the Royal Colonial Institute that an Agricultural College be established in the Tropics, and, as he pointed out in his presidential address at the recent International Congress on Tropical Agriculture, we seem to be moving in the right direction to secure at least one college, even if, owing to the war, we shall not see it rise up in Ceylon next year as we had hoped. Now, PROFESSOR DUNSTAN has remembered the requirements of the profession of tropical agronomists over here as well as in the Tropics, for he told us at the close of the same presidential address, referred to above :—"I have ventured to suggest three questions of general importance for special consideration, which it may be convenient to deal with in this way: (1) The establishment of an Imperial College of Tropical Agriculture, (2) the formation of a British Institute of Tropical Agriculture, which more particularly concerns the British Section of the International Association, and (3) the question of the constitution of the International Association, considered as a federation of central societies in the capitals of European countries, in communication with agricultural societies and institutions in the Tropics.

In his plea for a British Institute of Tropical Agriculture, PROFESSOR DUNSTAN said:—

"In dealing with the question of proper provision for technical education in tropical agriculture, as well as in considering other matters of importance to the subject, advance is retarded by the absence of any unofficial society or institution in this country which can claim authority to speak in the interests of British tropical agriculture, and represent the opinions and promote the interests of those who are engaged in what ought to be regarded as an honourable profession. The matter is outside the sphere of any Government Institution, and the International Association for Tropical Agriculture, by reason of its constitution, obviously cannot assume these duties; in fact, British relations with the Association are hindered by the absence of any British society of the kind. Surely the time has come for the formation of a society comprising all interests in a subject which is so profoundly connected with the welfare of the Empire.

"I desire to submit to the British Section of the Association for its consideration, and for such action as it may consider expedient to take the question as to whether it is not desirable to proceed to form a British Institute of Tropical Agriculture, whose functions would include the holding of meetings for the reading of papers, the discussion of all matters concerning tropical agriculture, and the consideration of education and qualification for the profession, and, in fact, doing whatever it may consider desirable to promote the interests of the subject of tropical agriculture, and of those who are engaged in it. My own experience in the period of twenty years during which I have been closely in touch with the subject, and with those who are working for it in all parts of the world, has led me to the conclusion that action in this direction is much needed, and that the establishment in this country of such an institute on the lines of those of other professional bodies, such as the Institutions of Civil, Mechanical, and Electrical Engineers and Institute of Chemistry, and many others, would be welcomed by all those who, as specialists, planters, merchants, or manufacturers, are connected with the subject of agricultural production in the British Tropics.

"A British institute of the character indicated would, of course, be affiliated with the various agricultural societies in the British Tropics and with the International Association, and would, with great advantage, take over the work at present performed by the British Committee of the Association.

"The best method by which those countries which are connected with the International Association can co-operate in its work and strengthen its action are to be considered at a meeting of the members of the Association at the close of this Congress. I feel satisfied that the large work which lies before the International Association will be best promoted by a scheme involving the affiliation and close co-operation of a society or institution in each of the European countries interested in the advancement of tropical agriculture, and our Continental colleagues have expressed the wish that this opportunity should be taken to elicit the views of the British members on this important subject."

In conclusion, we can only commend the idea to our readers, especially our own folk, and trust that they will collaborate with the "father of the idea" to develop it and make it grow up to a healthy and vigorous maturity.—

TROPICAL LIFE.

GREEN MANURES AND WEED SMOTHERERS.

(See Frontispiece.)

There is still a large proportion of Rubber estates on which weeding is a very heavy item of expense, and any satisfactory solution of the problem would, more especially under the present circumstances, be welcomed by many proprietary or company owners. No remedy however, it may safely be stated, can be devised or applied without a certain amount of expenditure, so that weeding must always be looked upon as a necessary evil. Like the poor, it is always with us. But we are liable to forget that weeds may, after all, be a blessing in disguise, for the operation of destroying them, whether by mechanical means or by the agency of green-manure crops, is an essential part of the process known as cultivation. A weed may be defined as a plant in the wrong place, so that a plant which may otherwise be of a useful character may become a weed.

Weeding enters very largely into the economy of planting in the tropics, though the best system of carrying it out is sometimes a disputed point amongst planters. As is well known, one of the most economical and at the same time beneficial methods is to grow green-manure or cover crops between the rows, to be periodically lopped, the loppings being either buried or used as a mulch on the surface of the ground. It should be remembered that a layer of mulch is in itself an efficient method of destroying weeds, apart from the benefits it affords by supplying humus and conserving moisture in the soil. Thus the benefits of a suitable green-manure or cover-crop especially in light sandy soils, are many-fold and may be briefly summarised as follows :—

(1) The addition of humus or vegetable matter to the soil, which increases its capacity for retaining moisture.

(2) The prevention of surface-wash on steep land.

(3) The improvement of the mechanical condition of the soil by the action of the roots of the green-manure or cover-crops.

(4) The protection of the soil and roots of crops from the excessive heat of the sun.

(5) The suppression or diminution of weeds, and therefore economy of labour.

(6) The fixation of atmospheric nitrogen in the soil by leguminous plants, especially those of the sub-order Papilionacæ.

Whilst all plants, weeds included, are useful for adding organic matter to the soil, when dug into it in a green state, yet all are not equally valuable. However well the first six of the objects above named may be achieved by the use of non-leguminous plants as a green-manure, it is generally believed that only leguminous species have the power of utilising free nitrogen, which they effect through the agency of bacteria nodules on their roots. Therefore the necessary qualifications for a good green-manure plant are, (1) that it should belong to the leguminous family, (2) that it should be of a herbaceous or succulent character, (3) that it should be a rapid grower. Creepers or climbers are not so suitable as bushy perennials, and if used, care must be taken that they do not twine round the stems of the growing crops.

Of all plants tried for green-manuring purposes, probably none answer these requirements more satisfactorily than *Tephrosia candida*, commonly known in the East as Boga-medelloa. A native of India and Malaya, it thrives from sea-level to 5,000 feet elevation ; it has been found to yield from 3½ tons of loppings an acre per annum, representing about 50 lb. of nitrogen. The frontispiece shows a young rubber field at Henaratgoda Botanic Gardens interplanted with this crop, the latter being about four months old. It will be seen what an excellent cover it forms. *Cassia hirsuta*, represented in the other plot on the same page, is an introduced species from South America which has become naturalised in Ceylon. It is a quick-growing plant and forms an excellent cover. The plot here shown was grown at the Experiment Station, Peradeniya, being about four months old from seed when photographed. Though also belonging to the Natural Order Leguminosæ, this comes under a different division to the Tephrosia, viz., *Cæsalpiniæ*, which is not characterised to the same extent as the division *Papilionaceæ*, to which *Tephrosia* belongs, by the presence of bacteria nodules on the roots.

H. F. M.

COFFEE CULTIVATION IN UGANDA.

W. SMALL.

Coffee is the staple crop of European planters in Uganda; exports have risen from about 10 tons in 1908 to 167 tons in 1912-1913, and are still rising as the estates gradually come into bearing; the exports for the 9 months ending December 31, 1913, were double those for the whole preceding year. There were 4,568 acres under coffee and 2,659 acres under rubber and coffee in March 1913.

The indigenous coffee plant is *Coffea robusta*, but this is only cultivated by the natives and consumed locally; Europeans plant the so-called Nyasaland and Bourbon varieties, said to have been imported from Jamaica and Aden respectively and both derived from *C. arabica*. Little care has been taken so far with seed selection, but both these varieties thrive well and yield heavy crops the fourth year. The outbreak of coffee leaf disease at the end of 1912 and the epidemic in 1913 led planters to give some attention to other forms of coffee, and experiments are now being carried out with *C. liberica*, *C. stenophylla* and *C. robusta*. With regard to climate, soil and altitude, Uganda is eminently adapted to the production of coffee.

The question of permanent shade in coffee plantations is still in the experimental stage; results obtained up to the present have not been favourable to permanent shading, but the matter has not yet been given a sufficiently extensive trial. The silky oak (*Grevillea robusta* A. Cunn.) is being tested for this purpose and various species of Leguminous trees, also para rubber trees which have the advantage of being profitable and the disadvantage of being subject to a root disease which also attacks coffee. The question of cover crops is also being investigated.

The strong, steady winds which occur periodically in certain parts of the country have to be guarded against, and high or low wind belts can be made with various trees, bananas being a favourite subject as they provide food for the native population at the same time.

Hemileia disease is endemic in Uganda and its appearance in the form of an epidemic in 1913 may be attributed to the fact that it was suddenly provided with a new host plant; despite the prevalence of this disease, the outlook is favourable, for the indications are that its virulence will be less in the future than in the past; the fungus, being endemic in Uganda, cannot be expected to work the havoc that it has wrought in other countries into which it was introduced. Planters are recognising that much depends on their efforts to eradicate it, and the Department of Agriculture is alive to the situation. In dealing with white ants (termites), exterminators have been used with success. The ravages of these pests are unequal, and in some parts they have caused little or no damage to growing plants.—MONTHLY BULLETIN.

CEYLON PEASANTRY.

TO THE EDITOR OF THE TROPICAL AGRICULTURIST.

DEAR SIR,

MR. BALFOUR, the Director of Irrigation, has generously drawn my attention to an error in the table embodied in my contribution which appeared on page 236 of THE TROPICAL AGRICULTURIST for September last. I noted that charge "to meet water rate" on one *avanam* sowing extent was two *avanams* paddy (15 bushels). MR. BALFOUR points out that this must be an error, as recovery of water rate in the Eastern Province averages less than Rs. 1/- an acre, i. e., about Rs 2/- for the extent under notice, while the quantity charged, 15 bushels, would represent, in value, from Rs. 18·75 to Rs 30/-

I acknowledge the correction with gratitude.

I made enquiries in order to find out to what extent, in the light of this correction, my balance sheet would stand corrected, and am informed that my error was merely one of nomenclature, not one of figures, that the charge, 15 bushels, was right, but that I should have described it as literally "rate and rent."

It is explained that the charge represents $\frac{1}{5}$th share on the gross produce which is levied by the landlord. In former times, he paid from it the Crown rent, $\frac{1}{10}$th share, popularly known as paddy tax and the balance went to defray expenses on account of irrigation labour or to meet interest on outlay on improvements.

After the abolition of paddy tax the levy has undergone modification: the same rate is still levied under the same designation: "to meet rent and rate." It is from this levy that the landlord pays water rate which is only about Rs. 2/- for the area under notice.

When customs prevailing in other rice growing districts are compared with those of Batticaloa, it is obvious that the metayers here are placed at a disadvantage. It will be seen from the balance sheet in my contribution referred to that, after all the charges have been met from the produce, the landlord still shares the residue half and half with the metayer. In defence of the landlord, it is urged that value of lands having risen his profits also must rise correspondingly. This may be so, but the method pursued does not seem to secure the end in view. MR. FREEMAN, a former Government Agent of the Eastern Province, has observed, with reference to paddy cultivation in Batticaloa, that native landowners are often Shylocks with the re ult that both cultivator and *cultivation suffer*" (italics are mine).

If facilities are open to the poor metayers to become tenant farmers under the Crown or to purchase property with provision to pay the purchase amount yearly by a certain share of his crop till the debt is liquidated, perhaps the landlords might be influenced to meet the new situation thus created by treating their metayers to more liberal terms. In other districts the social organisation operates as an agency of mediation to secure fairplay for the metayer, while in Batticaloa its influence is lacking. Perhaps village councils might with advantage be authorised to exercise functions of Boards of Conciliation or arbitration in case of differences between landlords and metayers.

Yours truly,

R. CHELVADURAI-PROCTOR.

"Premini Villa," Maradana.

TRANSMISSION OF CUTTINGS.

W. J. B.

The term cutting should be taken to include also "scions," or pieces of living branchlets used for grafting. It is more often possible to establish imported twigs as grafts on stocks of an older species of the same genus than it is to make them take root on their own account. In selecting pieces to send, they should, if from deciduous trees, be sent in the winter or leafless state, and they may be nine inches or more long. Growths well ripened and of average vigour should be chosen, neither too gross and sappy on the one hand, nor too weak and twiggy on the other. Shoots scarcely the thickness of a penholder are on the whole the most convenient size for grafting, and in cases where the one-season wood is much more slender than that, two-season shoots should be sent. Cuttings for rooting are nearly always made of one-season wood. Shoots of woody evergreens, like hollies or oaks, if to be sent long journeys, may have the leaves wholly or partially removed. One of the most important matters in connection with sending shoots for grafting or for cuttings is determining the right moistness of the sphagnum or other packing material. It should be moist but not saturated. The matter is, of course, dependent to some extent on the nature of the wrappings and their capacity for preventing escape of moisture, but the mistake of making the packing materials too wet is more often made than is the reverse.

A useful method. especially when the cuttings have to be sent long distances, is to pack them in a ventilated box, with their ends (both top and bottom) bedded in clay balls, the middle part uncovered. The box should be of the right size to enable the cuttings to be packed across it all one way so that the clayed ends fit against the sides. In this way the uncovered middle part of the cuttings is in free air, and "sweating" is prevented.

Cuttings that arrive in a shrivelled but still living state should be submerged in water for a few hours to regain their plumpness.

Examples of genera, of which leafless cuttings for rooting may be safely sent long distances are: *Salix*, *Populus*, *Rosa*, *Ribes*, *Neillia*, *Spiraea*, *Tamarix*, *Cornus*, *Forsythia*, Root-cuttings, if the collector can secure them, would be useful of such genera as *Rhus*, *Ailanthus*, and others with fleshy root.

As a general rule, leafless cuttings for rooting should reach England as soon as possible after the leaves have fallen. Grafts and root-cuttings need not arrive until spring. It need hardly be said that every precaution should be taken not to introduce in this way a new insect or fungoid pest.

Leafy summer cuttings of hardy trees and shrubs have been very successfully transported from America to England in the month of July. The cuttings were tied in small bundles of half a dozen or so and laid loosely in shallow baskets with damp moss about the stems, the leafy parts being left uncovered. The basket was then tied down with canvas. It is, of course, only possible to send over cuttings in this way by arranging with the purser or other officer on board ship that they may be kept in the cool storage. For hardy things it was found that a temperature of about 42° Fahr. was very suitable. Cuttings ten days in transit have been found to root well, but perhaps a fortnight is about the limit for this class of cutting.—KEW BULLETIN.

RAINFALL FOR SEPTEMBER, OCTOBER AND NOVEMBER, 1914.

Place.	September.		October.		November.	
	1913.	1914.	1913.	1914.	1913.	1914.
	in.	in.	in.	in.	in.	in.
Colombo ...	2·63	3·41	4·91	16·02	12·89	9·64
Kandy ...	2·36	6·35	27·05	10·08	10·49	9·17
Galle ...	4·82	4·96	10·55	14·99	6·26	7·80
Jaffna ...	4·82	3·60	10·20	19·64	31·40	12·88
Anuradhapura ...	1·50	2·84	12·67	15·05	12·85	9·21
Kurunegala ...	2·35	6·09	26·83	18·59	12·01	12·20
Batticaloa ...	0·20	1·51	5·90	11·93	11·01	24·38
Badulla ...	2·40	4·66	11·61	11·51	6·27	7·83
Ratnapura ..	10·35	12·73	35·00	14·64	13·11	12·24
Nuwara Eliya ...	3·60	9·40	18·58	13·57	8·41	8·32

PRESERVING TIMBER FOR THE ESTATE.

The experiments were undertaken mainly to ascertain whether the creosote treatment for preserving timber would with advantage be modified or cheapened.

Different lots of timber were treated with pure creosote, with creosote saponified by the addition of a very small proportion of caustic soda, and with naphthalene. Although the experiments are not nearly complete, it has been found, so far, that the addition of a small quantity ($\frac{1}{4}$ per cent. or less) of caustic soda to pure creosote improves penetration in the case of timbers which take the preservative with difficulty, and that the saponification of the

creosote makes it possible to dilute the preservative by the addition of water, thus cheapening the creosoting process. For the treatment of estate timber by the simple open tank method, saponified diluted creosote would seem to be a cheap and effective substitute for the Rüping process used by the professional creosoters. Good results were obtained when average creosote was diluted to half its full strength, but diluted to a greater extent than this the penetration was found to become less complete, especially in the case of green or only partially seasoned timber.

The advantages of using naphthalene as a preservative are that green timber can be treated as effectively as air-dried timber, and that the discolouration of the timber is less than with creosote. It is also an excellent preservative, but large quantities are taken up by most timbers, and at present prices the process is not, on the average, less costly than creosoting.—JOURNAL OF THE BOARD OF AGRICULTURE.

HARVESTING AND STORING OF GARDEN VEGETABLES.

Allotment holders and occupiers of small gardens seldom grow sufficient vegetables to last all the winter, and in many cases do not think it necessary to make arrangements for storing up their crops. The produce, however, of even a small garden, if it is suitably stored, can be made to last much longer, while the allotment of garden can be more profitably cultivated if each crop is lifted at the proper time, and the land is at once dug over in preparation for the next crop. Constant digging, hoeing and turning over the soil tends also to keep down insect and fungus pests, and to secure a better yield for each successive crop.

HARVESTING THE CROP.

Nearly all vegetable crops should be harvested as soon as they are ripe, as delay favours the development of disease. In most cases the proper time is obvious from the appearance of the plant. Thus potatoes should be lifted when the haulm begins to die; artichokes when the leaves begin to wither; onions when the bulbs are sufficiently large, the leaf-tips turn brown, and the leaves appear "slack" (the necks should be bent over to the soil a few days before the onions are lifted, and the skins should be allowed to die in order to make the bulbs round); cauli flowers should be cut before the "flowers" loses its white curdy appearance; carrots should be lifted before the autumn frosts begin and when the older leaves show signs of withering; broccoli in the Midlands and the north of England (it is not necessary in the south of England) should be laid over facing north on the approach of winter, to prevent damage to the colour of the "flower," and to enable the crop to resist a hard winter so that they may be cut in good condition in early spring; celery is ready for lifting as soon as the earthed-up stems are sufficiently blanched; and parsnips may be left in the ground and be raised when required, even after the tops have died down.—LEAFLET No. 15, BOARD OF AGRICULTURE.

COOLY GARDENS.

PERCY HERFT, BURMA.

We have planted about 30-40 varieties of catch crops such as yams, potatoes, water-melons, brinjals, asparagus, beans, cucumbers, chillies, pumpkin, and several other vegetables. We find they pay us well and help us a great deal towards the expenses of the plantation [coconut].

I urge all our coolies to plant any crops that would suit them, for which I grant them land adjoining their lines, and supply them with seeds. Most of the coolies have now cultivated nice little gardens during their spare time, and they are well supplied with their own vegetables. Our idea in doing this is to keep the coolies away from the bazaar, where they may be led astray by outsiders and make them comfortable here so that they would settle down here for some years as many of them are with families.

THE GOLD COAST COLONY.

REPORT FOR 1913.

The following is a comparative table of the quantities and values of the principal articles of export from the Gold Coast Colony for the years 1912 and 1913:—

Article.	1912.		1913.	
	Quantity.	Value.	Quantity.	Value.
		£		£
Cocoa - - -	86,568,481	1,642,733	113,239,980	2,489,218
Kola nuts - -	7,133,165	134,231	7,024,868	144,705
Copra - - -	620	11,841	629	14,292
Gold & gold dust ozs.	377,659	1,439,268	422,602	1,626,003
Auriferous By-products ,,	160,024	31,392	148,935	30,107
Lumber (native timber) sup. ft.	23,573,651	228,745	37,391,848	366,094
Palm kernels - -	14,628	205,365	9,744	159,128
Palm oil - - -	1,144,432	112,885	860,165	65,652
Rubber - - -	1,990,699	168,729	1,317,369	87,915

The increase in cocoa was due to the fact that a great number of farms had come into bearing, principally in Ashanti and in the Central Province of the Colony, and also to the fact that the season 1912-13 being late, a large proportion of the crop was shipped in 1913. There was a decrease in the quantity of kola, but an increase in value. The decrease is considered to be without special significance. The higher value is accounted for by the imposition of an import duty in Nigeria towards the end of 1912. The exports of gold and lumber are the highest yet recorded. With regard to the former, though fewer mines were working, more stamps were running. The lumber industry was assisted by the heavy floods during July and August in the Ancobra and Tano Rivers. The fall in the exports of rubber, palm oil, and kernels is due to the fact that at the present moment cocoa farming is far more profitable and far less laborious than the oil or rubber industries. The total value of the exports for the five years, 1909-1913, is as follows:—

1909	£ 2,655,573
1910	2,697,706
1911	3,792,454
1912	4,307,802
1913	5,427,106

The total value of all shipments (exclusive of specie) to the United Kingdom in 1913 amounted to £3,416,637—an increase of £739,062, or 27 per cent as compared with 1912.—INDIAN TRADE JOURNAL.

THE DYEING AND TANNING INDUSTRY.

The way in which the war is affecting the dyeing industry in India and the difficulty of utilising original vegetable dyes in place of modern coal tar products (the bulk of which came from Germany) is indicated in the following extract from the INDIAN TRADE JOURNAL which illustrates the position in the case of Madura in South India. The views are those of DR. MARSDEN, Dyeing Expert to the Government of Madras who says:— "I am informed that some 5,000,000 lb. of yarn with a computed value of 25 lakhs are annually dyed in Madura with alizarine. The value of the dyed yarn produced is given as 35 lakhs. The possibility of maintaining the industry by taking again to the vegetable dyeware has been under discussion, and opinion upon the question is much divided. It is generally felt that it would be well if the roots were available, even though the cost of dyeing would be much greater than it has been with alizarine. and the process more tedious, but there is a fear that the range of shades which it is possible to dye with alizarine (and especially the bright ones) cannot be dyed by using the madder root. The question of importance at present, then, is the quantity of root which is available. I understand that the plant is widely distributed in the Cuddapah district, but is not to be found in commercial quantity in any single locality. I am informed from another source that Kumbakonam is the seat of the madder root trade, and that some 6,500 lb. are available here and another 1,500 lb. in Madura. The prices range from Rs 4 to Rs 5 per thulam of 25 lb. Taking the alizarine content at 4 per cent. (although it is most unlikely to be so high) this would work out at a price almost double that of artificial alizarine. The information regarding the period required for cultivation is apparently conflicting, and I communicated with the Agricultural Department to obtain definite news upon this point. I am informed with regard to *Morinda citrifolia* that this shrub requires two to four years for its growth.

The general opinion of the dyers in Madura, I gather, is that the dyeing industry there could not be maintained in its present position if it were to be dependent upon madder root, the condition of the trade having so materially altered with the introduction of alizarine. The annual imports of alizarine into Madura, according to a recent enquiry, appear to be some 500 tons of 20 per cent paste, and this demand could only be met by the production of some 2,500 to 3,000 tons of root, assuming the alizarine content of this to be 3 to 4 per cent.: this in the past appeared to contain very much less." *Morinda citrifolia* and *M. tinctoria* (*Sinh.* Ahu) are common in the Island.

The position as regards tanning material is also acutely felt by the trade particularly at a time when there is so pressing a demand for leather equipment for the Army. According to the OIL AND COLOUR TRADE JOURNAL the value of tanning extracts imported by British tanners last year was nearly a million pounds, and in view of the greater part of the supply which came from the Continent being cut off, the leather industry is considerably affected. The trade will now have to be satisfied with Hemlock and other extracts from America, quebracho from South America and Wattle from Australia and the Cape and mangrove from the East, though the preference is for the better known extracts of chestnut, oak and sumach from the Continent.

It is particularly interesting to read of mangrove bark (which is available in the Island to a considerable extent) that tanners are gradually appreciating its value, and it is encouraging to find the Journal referred to expressing the following opinion: "There will never be a time in the history of the nation like the present for entering the market, and senders of tanning agents may feel that to a large extent they are assisting their country in a patriotic manner

and, in addition, building up a trade which might mean a profitable business to themselves in the near future."

Ceylon is especially rich in tanning agents such as the bark of *Cassia auriculata*, *Careya arborea*, *Rhizophora mucronata*, and the nuts of species *Terminalia*.

C. D.

PRODUCTION OF VANILLA IN THE FRENCH COLONIES.

Martinique.—Vanilla was introduced into this colony a long time ago (about 1697), but its cultivation has not spread much and it seems at present to remain stationary. During the four years from 1908 to 1911 the greatest exportation took place in 1909 (4,590 lb., worth about £1,520), the least in 1911 (2,536 lb., worth about £955).

Guadeloupe.—*Vanilla planifolia* was introduced in 1701; artificial pollination was begun in 1839, and a few years later the exportation of vanilla began; in 1911 it amounted to 39,267 lb., of the value of £13,352. The greatest quantity was exported in 1908: 68,242 lb., worth £10,871. Besides Mexican vanilla (*V. planifolia*,), the native vanilla (*V. pompona*) is grown to some extent.

Guiana.—*Vanilla planifolia* was introduced about the year 1870 by the Administration of the penal settlement but it did not gain a footing and its cultivation is now abandoned.

Gaboon.—The cultivation of *V. planifolia* has developed gradually during the last fifteen years. The vanilla exported in 1911 was 891 lb., worth about £1,102. Vanilla has often been found wild in both the French and Belgian Congo.

Mayotte and Dependencies.—Vanilla has been cultivated in the Comoro Islands since 1875. At present it is the principal crop of the archipelago; in 1909 the crop amounted to 91,525 lb. The greatest quantity is produced by the island of Anjouan (1,200,000 plants,); the quantity harvested in 1908 was 59, 342 lb., worth £32,031; the island of Mohéli gives the best quality. Mayotte possesses about half a million plants.

Madagascar and neighbouring islands.—Vanilla is not native to the island, but it is now widely spread, especially along the east coast. The neighbourhood of Tamatave seems to be too moist for *V. planifolia*, but might perhaps be suitable for species. In 1908 there were already at and round Vatomandry about 181,000 plants, and during the last twenty years this crop has attained real importance in the island, especially in the provinces of Vohemar and Antananarivo, in the districts between Andevoranto and Mananyari. In Madagascar it does not encounter any serious natural obstacles, but the market is limited and the island is near other competing centres of production, such as Réunion, and the Comoro Islands, the plantations of which are in full bearing and producing a vanilla which enjoys great repute. The exports began to be important in 1896; in 1911 they reached 115,589 lb., worth £87,452. The vanilla of Nossi-Bè is especially renowned, but, like all Madagascar vanillas, is somewhat lacking in perfume.

Réunion.—Vanilla has been grown in this island for about a century and it has also been exported for a long time, but it was only after 1862 that exportation became considerable. The so-called "vanillon" (the exportation

of which began in 1884) is not *V. pompona* but the pods of *V. planifolia* less than 5½ inches in length. The cultivation of vanilla is somewhat decreasing in Réunion, but the island still occupies one of the foremost positions among the countries producing this commodity. Almost the whole of the crop is exported. The graph of the exports from 1896 to 1911 presents maxima, in 1898 and 1902, respectively 442,046 lb., worth £273,057, and 439,526 lb., worth £107,196 ; in 1911 it was 146, 610 lb., worth £73,606.

Bourbon.—Vanilla is grown almost everywhere up to 100 feet above sea-level ; it thrives better, however, in the windward part of the island than in the leeward. Bourbon vanilla ranks in the trade as vanilla having a strong perfume, while the Mexican vanilla perfume is delicate and sweet.

New Caledonia.—It appears that vanilla was introduced about 1861 and that only parts of the island are suitable to its cultivation. Experiments carried out on medium soils in the neighbourhood of Nouméa gave good results, but then the introduction of coffee raised more interest and vanilla was abandoned. In 1901, 234 lb., worth £127, were exported, but in 1911 only 2 lb.

Tahiti—V. aromatica was introduced in 1848 and is now widely spread. It is grown chiefly by the natives ; the pods are picked too soon and their preparation leaves a good deal to be desired ; the result is that the produce is sold at a low price, chiefly to Germany and the United States. In 1902 318,525 lb. were exported, representing a value of £47,493 ; in 1903, 289,761 lb. worth £23,461. After 1904 the exports from Tahiti are included in those from Oceania, which comprises Tahiti and Moorea. In 1911 it amounted to 467,567 lb., worth £95,944.

French Establishments in India—At Pondicherry vanilla was introduced into the Botanic Gardens of the Colony about 1879. The production began to be regular after 1888 ; it reached a maximum in 1901, with 280 lb., worth £175. The soil and climate of the French establishments in India are not suitable to this crop, and the prices realized are not sufficiently remunerative.

Indo-China.—Vanilla was introduced about 1865 to the Botanic Gardens of Saïgon, but it has not gained a footing in the country.

The exportation of vanilla from all the French Colonies amounted in 1911 to 948,988 lb., worth £388,832. The French Colonies produce about two-thirds of the vanilla produced in the whole world. Its consumption in France between 1907 and 1912 was about 132,300 lb. per annum.—MONTHLY BULLETIN.

CURING VANILLA BY THE BOURBON PROCESS.

This process is used throughout all the Islands that produce this variety and differs mainly from the Mexican by reason of the fact that the vanilla is never submitted to the direct rays of the sun at any time during the process of curing.

The green beans, after first being sorted into equal lengths, are put in open-work baskets, which are then plunged into large pots containing water heated to within a few degrees of the boiling point, where they are allowed to remain from fifteen to twenty seconds. After coming out of the water they are placed upon mats to drain and when this is accomplished they are heaped into a pile, covered with blankets, and allowed to dry for a short time, after which they are taken into the open, spread upon matting and well covered with blankets. They are allowed to remain in the sun for several hours during the hottest part of the day.

In the afternoon they are taken up and placed in large, blanket-lined, hermetically-sealed cases, very similar to the Mexican "Calon," where they are left over night. The next day this programme is repeated. In all they receive this treatment about eight times on consecutive days, if the weather permits. After this they are put on frames in a well aired drying-room and left there for a considerable period, being examined from time to time as to their condition and flavour.

When this is satisfactory they are placed in a depository and again left for some time for further development, and when this passes inspection they are taken out to be bundled. Having previously been sorted according to lengths, nothing remains but to grade them as to quality.

SIX GRADES OF BOURBON BEANS.

There are six grades to the Bourbon, namely: Extra, First, Second, Third, Ordinary and Inferior. There are a few short beans which are shipped without bundling and which are styled "Vrac," but the proportion of these is quite small. They correspond to the "Picadura" of the Mexicans and their scarcity may be explained by the fact that the Bourbons are bundled down to a very short length; as short as $3\frac{1}{2}$ inches, from which they run up to about $8\frac{1}{2}$ inches, whereas the Mexicans seldom bundle anything under 6 inches, from which they run up to 9 inches. The average length of the Bourbons has been decreasing of late years, while, if anything the Mexicans have increased.

THE MEXICAN CURING PROCESS SUPERIOR.

In regard to the merits of the two processes, the Mexican is by far the superior. It consumes six months and each individual bean receives more care and attention, while the Bourbons are forced through in three months. This is bound to tell in the long run, and in the opinion of the writer (WALLACE MAWBEY) after many years of practical experience, a Mexican bean properly cured will keep indefinitely improving in flavour for a number of years, whereas the same thing cannot be said of the Bourben bean. It may keep and improve for a year or two years or even more, but sooner or later it deteriorates.

Under normal conditions the percentage of poorly cured Mexicans is very small, while there is always a large percentage in the Bourbons, sometimes running as high as $33\frac{1}{3}$ per cent. Climate and soil may have something to do with this, as Mexico is more favoured in this respect than the Islands, but the method of curing has more to do with it.—INDIAN AGRICULTURIST.

POLING OF SISAL HEMP.

MR. H. H. COUSINS, Director of Agriculture, Jamaica, in the JOURNAL OF THE JAMAICA AGRICULTURAL SOCIETY, draws attention to the soil requirements of Sisal Hemp and Henequen. He states that the natural soil of the Sisal Hemp (*Agave rigida, var. sisalana*) is that of a limestone formations. It has been demonstrated that if cultivated on such a soil this species will grow for several years without poling. It must be remembered that this premature poling is what the planter of Sisal hemp has to combat. He also says that cutting the leaves at three years instead of four years has been proved to render the plants less liable to premature poling.

As regards Henequen (*Agave rigida var., fourcroides*), MR. COUSINS shows, by cutting several instances of plantations visited by him in Jamaica where it is being grown experimentally, that this species can be successfully cultivated on dry alluvial soils which are very deficient in limestone.

A CEYLONESE ON TOUR IN THE BOMBAY PRESIDENCY.

H. L. VAN BUREN.

The Bombay Presidency (including Sindh) is divisible into four agricultural tracts :—

(1) The alluvial tract of Gujarat in the North,

(2) The Deccan trap formation in the Centre,

(3) The Maharatta country in the South,

(4) The Konkan strip of coastland between the Western Ghats and the sea.

The soil generally is deficient in humus, and agricultural practice is regulated by the question of soil moisture, the depth of soil, and the proportion of clay present.

To the north of the Deccan tableland lie the deep and fertile plains of Gujarat forming part of the great alluvial Indo-Gangetic plain, which though arid is well supplied with irrigation facilities.

South of the Deccan tableland the rainfall is greater and better distributed while the soil represents a transition from the well known black cotton soil to the derivatives of crystalline formations characteristic of the great part of South India and Ceylon.

On the Western part, surrounded by hills, lies the Konkan.

THE KONKAN.

This coastal strip, narrow towards the south and widening towards the north is seldom broader than thirty miles. It extends from 20° to 15° north Latitude. Laterite occurs in the south, but is rarely found north of Bombay.

Travelling from the coast into the interior, one passes through coconut groves on the sandy soils, on which also excellent crops of betel, plantains, ginger, etc., are raised with the aid of a good natural water supply and liberal manuring. It is not unusual for cultivators to apply as much as three tons of castor cake (in three dressings) per acre per annum. Such cultivation pays owing to its proximity to Bombay. The coast is indented by creeks which cause the inundation of extensive tracts of otherwise valuable land. The improvement of these saline soils is receiving the attention of Government. A variety of "salt rice" is cultivated in embanked lands which are subsequently brought under intensive garden cultivation.

In the southern part, cardamoms and pepper are grown under the shade of arecanut palms which also serve as a support for the latter. These gardens are established in clearings made in the forest, and the crops are raised in cuttings which go down below the laterite, with leaf manure from loppings from the neighbouring forest trees. The leaf manure is often first used as litter for cattle and brought on to the land together with cattle droppings. This system of cultivation is, however, dying out mainly due to restrictions placed on the lopping of trees in the interest of forest conservancy.

Sugarcane cultivation is being extended with the assistance of the Agricultural Department which has introduced improved methods of crushing the cane and evaporating the juice. The final product of this industry is known as "gul" which is a crude form of sugar akin to our "jaggery." Gul finds a ready market.

In the south the cane-sets are planted at the bottom of a pit in which loppings of trees, etc., have been previously burnt. As the canes grow taller the pits are filled up, and the cultivators believe that they thus get a superior quality of cane. The canes certainly produce a good growth with long internodes but they are liable to break down by their own weight.

VARKHAS LANDS.

On the hills the soil is very shallow being subject to wash, the finer particles going down to the rice fields below. The natural vegetation having been from time immemorial drawn upon for leaves and twigs for "rabbing" rice seed-beds, these hill-sides have been rendered more or less sterile and only support a poor scrubby growth. Patches of this scrub are cleared and cultivated with millets, e.g. *Eleusine coracana*, *Panicum milaceum*, *Paspalum scrobiculatum* after the manner of our local "chenas." Following upon cereal cultivation niger seed (*Guizotia abyssinica*) is grown, and this crop is remarkable in its ability to derive nourishment from depleted soils. The land is then left uncultivated, the natural grasses only being cut and sold for fodder, till the coarser scrub again prevails. The return of the land to cultivation takes places after from seven to fifteen years. One method of improving the condition of these lands is by building embankments to prevent erosion and this is one of the means of organising famine relief work in times of distress.

The earlier maturing varieties of ground-nut (Spanish and small Japan) have been found suitable as a rotation crop for such areas. The growing of San (*Crotalaria juncea*) as a green-manure crop has also been found to be beneficial especially after the condition of the soil has been improved by the construction of embankments.

RICE LANDS.

Most of the rice soils are fertile clay loams often with an admixture of grit. In dry weather they set as hard as brick, in many places causing a total cessation of agricultural operations for a period of nearly six months after the rice harvest. Where moisture is available a crop of *Dolichos lablab* is generally taken during the hot weather, while in the south a second crop of rice is obtained. Rice is almost invariably transplanted, and seed beds are generally situated at higher levels than the field.

The peculiar practice of "rabbing" the seed-bed is everywhere prevalent. Forests have been depleted by this wasteful practice and now many cultivators have recourse to the heating of the seed-bed with cakes of sun-dried cowdung.

These heated seed-beds are highly prized by the cultivators who subsequently cultivate them intensively with garden crops. One of the finest plantain gardens I ever saw was on an old rice seed bed. The origin of this method of soil heating is obscure but the benefits to the soil are obvious.

The Agricultural Department have a very difficult problem in the green-manuring of rice. The soil is so hard and unworkable during the period of drought that unless irrigation facilities are available it is next to impossible to grow *San* after harvesting the rice. Besides the crop cannot be ploughed in, and has merely to be rolled, so that its rapid and thorough decay cannot be assured. When the rains come on, the rice-fields become waterlogged so that the germination of *San* and the resulting growth are poor.

Dhaincha (*Sesbania aculeata*) is also being employed for green-manuring.

I may here mention that at Bassein I saw rice being grown in rows so as to allow of the soil being intercultivated.

The idea of utilising field embankments for growing leguminous crops, where such embankments are not required as foot paths, seems a good one. Lab-lab grown in this way not only occupies the waste land and keeps down weeds but also yields a good return. [The same practice is being followed in Ceylon, particularly in the Kandyan District where *Vigna sinensis* is frequently seen growing on the ridges of paddy fields.—ED. T. A.]

ZANZIBAR AND PEMBA CLOVES.

F. C. McCLELLAN.

A plantation in Pemba of about 4,000 trees, and under efficient white management, yielded in 1913 (a heavy crop year) 20 lb. of dry cloves per tree—the actual crop on trees in bearing being about 35 lb. This plantation bears an average yearly crop of 8 lb. per tree. In the same season trees 10 years old yielded 1¼ lb. of dry cloves per tree. Many of the largest trees in Pemba will, in a good year, yield 60 to 70 lb. of dry cloves per tree. A good crop is obtained once every three to five years, and the average yield of the Arab-owned plantations is about 3½ to 4 lb. of dry cloves per tree per annum.

Apart from the peculiar climatic conditions of these islands, which apparently are very suitable to it, the clove tree requires a deep, well-drained soil, shelter from wind, and ample space. Though shade is desirable when young, full exposure to the sun is necessary for fruiting. On the hill-sides of sheltered valleys in Pemba it is more at home than on the more level ground of Zanzibar.

Provided proper attention is paid to the natural requirements of the tree and to its cultivation, the clove tree is more free from insect and fungoid attack than most trees, but, as in the case of all exotic trees, a careful and continuous scrutiny is necessary.

The cloves are gathered by hand, the pickers climbing the trees and drawing the branches towards them by hooked sticks. The method is wasteful, and results in much damage to the trees; but in many cases the trees are too tall for ladders to be used.

The stems are separated from the heads by hand, and the picker is paid for the stemmed cloves only, which are measured or weighed. The proportion of stems to cloves varies with the age of the tree. In a mature plantation of forty years old, 25 to 30 lb. of stems should accompany 100 lb. of cloves. But in ordinary management a much smaller proportion is obtained, as the Arab pays but little attention to them.

Drying is done either on a concrete, cement-faced drying floor, or on mats made from native palms. The former method is of course the best, and under it in fine weather drying is completed in from three to four days. Showers do not cause any harm provided the cloves are spread out on a barbecue and raked over. Drying in the sun does not cause the bud to shrivel, as has been stated; but the shrivelling so common in Zanzibar, and especially in Pemba cloves, is due to heating and careless drying.

Pemba cloves as a general rule fetch a lower price in the local market owing to careless methods of preparation, but those from two plantations which possess barbecues are finer than those from Zanzibar. Under similar conditions of age and soil, and with good management, Pemba plantations give the better results.

The Arab custom of piling the cloves in heaps during wet weather results in fermentation and blackening. Drying under glass has been tried, but with no measure of success. The tray system has been used and abandoned on account of the expense. A hot-air drier was erected by one plantation owner, but in the following year he reverted to the use of his barbecue.

One hundred pounds of green cloves will yield about 47½ lb. of dry cloves.—IMPERIAL INSTITUTE BULLETIN.

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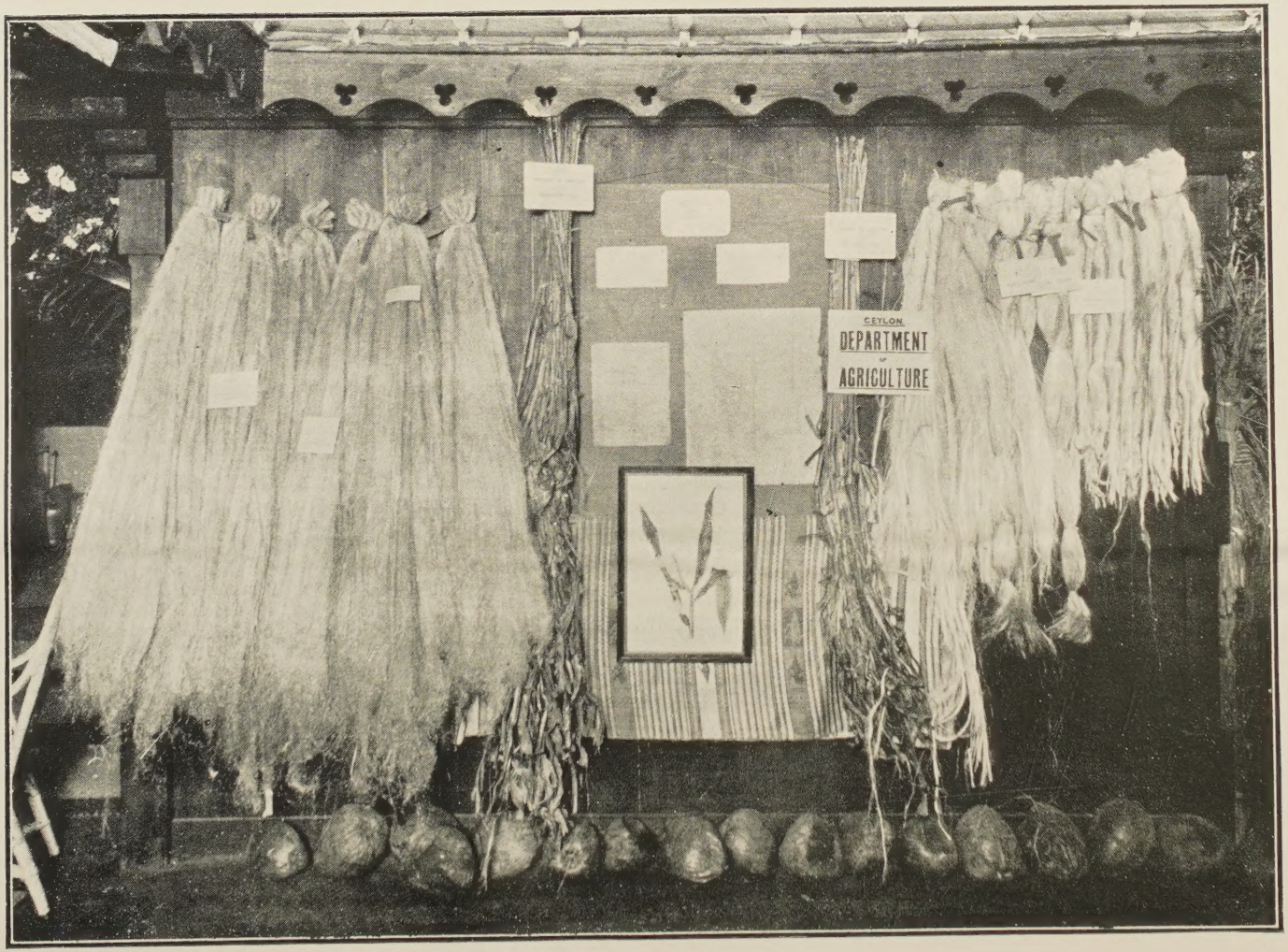

FIBRES AT THE CEYLON PAVILION, RUBBER EXHIBITION, LONDON, 1914.

Sunn Hemp, Hedychium Stems mounted on Sansiviera mat, Sisal Hemp, Sansiviera.
Coconuts below.